AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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New Pattern Boiler Front.

Our attention has lately been directed to a new, tasteful and convenient style of boiler front, designed and built by Mr. James L. Jackson, at his works in East 28th and East 29th streets, New York. The engraving on this page gives a view of one of these fronts in use at the above works with an 80 horse power boiler. The advantage of this boiler front over those of ordinary construction is not only in its beauty of design, but the usual difficulty of breaking by expansion and loosening of the brick work is entirely avoided.

The entire front is made in separate pieces, and the inner part extends behind the sides, thus giving entire freedom to expand or contract without strain on the side walls.

The fire doors are double with mica on both sides, giving full view of the fire, and the door-frame is separate from the front. The name and business of the purchaser is put on in large letters. One very decided advantage possessed by this front is that, with very little cost for alteration of patterns, it can be adapted to any size boiler, or where there are several boilers set together.

It is strong in its construction but not heavy, and but little more expensive than the ordinary flat boiler front. The steam gauge is placed at the side for convenient inspection by the engineer. So finely executed are the iron castings in this boiler front, that it would be no stretch of the imagination to call the whole front a work of art. When parties desire to make a complete finish on the sides and back, as well as on the front of the boiler, by dividing it into panels, drawings and estimates can easily be prepared.

The boiler upon which the front, herewith illustrated, is placed was built precisely upon the plan suggested and described (with a drawing) by Mr. William H. Hoffman, in the AMERICAN MACHINIST of December 6, 1879. It is set upon the Jarvis gas consuming plan, and with some special improvements by Mr. Chas. A. Berton, among others a shallow water reservoir in the ash pit under the grate to keep the latter from warping by the heat. Many waste substances that would not burn in an ordinary boiler furnace are consumed with good steaming results.

JAMES L. JACKSON'S NEW PATTERN BOILER FRONT.

Extract from Chordal's Letters.

Mr. Editor:

* * * * Mr. Huber is one of those lucky men who own boiler shops. He works about twenty or twenty-five boiler makers.

Mr. Huber got some button sets made, and one day last week went into the said boiler shop to introduce the aforesaid button sets. When Mr. Huber went into the boiler shop to introduce the button sets the boiler makers all went out of the boiler shop on a strike against the introduction of the button sets. I wish these men would put their cause of action into writing, and that you could get hold of the writ. It might be shown that the button set was a bad tool calculated to injure the reputation of a boiler maker who used it. In such case the boiler makers who read the AMERICAN MACHINIST ought to hear more about it. Probably the button set is a real bad tool, and that a conscientious boiler maker would scorn to use one for the same reason that he would any other bad tool. If Mr. Huber should take a drift pin into his boiler shop and say: "Here now you boys, when holes don't match by the width of a county you just drive this here pin in and make them match." I suppose, of course, the men would get on a strike at once—only they wouldn't.

The fact is, Mr. Editor, that the introduction of a bad tool into a boiler shop is not a certain method of starting a strike. May be the button set is a good tool. I can imagine some idiotic workman striking because some new tool worked better than the tools he was used to. In my own State and in several other States a certain class of men are kicking against oleomargarine or artificial butter. They want the business stopped by legislation; they want the product destroyed and the producers sent to the penitentiary. Not because the stuff ain't good, mind you. If it was bad they wouldn't say a word. It's entirely too good, and that's what the matter; and that's why they want legislatures to enact laws which will hang any man who attempts to extract butter from the other end of the cow.

* * * * May be Mr. Huber's boiler makers think the button set is too quick a tool and will allow Mr. Huber to reduce his price list ten per cent. This would give Mr. Huber lots of business and he would have to enlarge his boiler shop and get more boiler makers. This is dreadful to think about!

* * * * I know two chaps who tied up about four dollars worth of boiler tools in some old overhauls, and went out into a distant country and started a boiler shop. They did repair work. They put on cold patches, put on new sheets, put in new rivets, put in new flues and tubes, put in new fire boxes, &c. They did their bending over wooden logs and kept three boiler makers at work constantly. They got big prices and saved some money.

* * * * After building two or three new boilers in this crude way they took it into their heads that they would get some kind of a rig to punch holes for rivets. They had been drilling by ratchet entirely. The man who had been "running" the ratchet drill saw trouble ahead, no work, a starving family, &c.

He was quieted, just on the eve of a "strike," by assurances that his job was steady and that he might run the new punch when it came. Still he felt uneasy, for he foresaw that the punch would do a day's ratcheting in half an hour. Where he was to get his other nine and a half hour's work was a mystery. Things looked still blacker when he remembered that there was not work enough to even keep the ratchet drill going.

* * * * This artist of the ratchet knew lots of things, but one thing he didn't know. He didn't know how hard the bosses had to work to get a job at the prices they were compelled to ask, and he didn't know how little margin of profit there was in it after the job was gotten. He didn't know that his own low wages, as operator of the ratchet drill, made the cost of boilers so high that six contemplated saw mills were never built—just on that account. He got a dollar a day, and saw suffering and idleness ahead. In the bitterness of his woe he would have smashed all the punching machines in existence if he could have done so.

* * * * The new punch came all the same, and poor Dan was placed in charge. With saddened heart he saw the vicious tool punch holes ten hours a day. He wondered where the new demand for holes came from, and he wondered how the bosses had been able to raise his wages half a dollar a day, and how they managed to find work for three more boiler makers than they had before.

* * * * Three years time saw poor Dan as boss of three punching machines. He tried to wonder what the fifty men were doing who might be ratcheting these holes, and then he remembered that when the ratchet was depended on, only one man was employed in making holes while now there were four, and besides that there were thirty boiler makers at work in the shop. Instead of sheets being bent over a log, labor-saving rolls were used. There had been a kick against these rolls. A steam riveter stood in the middle of the shop and worked steady; and a business-like tool cut half a dozen tube holes at once, and orders for boilers came in, and boilers went out, and sawmills were built, and lumber got down to a price and wages got up to a figure where a boiler maker could live in a house as was a house. Poor Dan!

* * * * One fine day one of the bosses brought into the shop a gauging rig for one of the punches. This thing was some sort of a self-feeding frame, which spaced the holes and punched them on big circles so as to bring the rows straight when the sheet was rolled up into a tapering ring.

* * * * This gauge made trouble; and Mr. Mulligan, as spokesman of a meeting of boiler makers, explained that the devilish gauge was well calculated to take the bread out of boiler makers' mouths. He went on to explain in eloquent terms that all these labor saving traps were throwing men out of work and leaving their families suffering; that the bosses were, by their means, enabled to do the same work with less men, and could put that much more money in their own pockets; that he had nothing against the bosses, but the working men must guard their interests or prepare to suffer. Then he showed by figures, which never lie, that this

gauge would do the work of three men laying out work and do it better; that the steam riveter was doing work six more men ought to be hired to do; that the bending rolls were doing work three more men ought to do; and that the punching machines were doing work ten men ought to be doing. He said he liked the bosses, and didn't favor destruction, but he really felt that if all these things were back in the form of pig iron there would be a hundred men working in the shop instead of twenty-five or thirty. He was in favor of expressing to the bosses the general good will of the men, but of insisting on the new gauge being abandoned. They would work hard and do their duty, but it was not asking too much of the bosses to ask that the new gauge and similar traps be kept out of the shop in the future.

* * * * Then poor Dan took the floor and, with the permission of the chairman, asked Mr. Mulligan a few questions. Mr. Mulligan was a free and generous soul, and went into the catechism class cheerfully.

First question by Dan.—Mr. Mulligan, did you ever work in a boiler shop when some great labor saving device was put into use and kept in use? If so state the circumstances.

Answer by Mr. Mulligan—I worked for McLean when they got a flanging machine intended to revolutionize the trade. The thing was a fraud, and was laid aside in a month. It was an experiment and a failure.

Second question by Dan.—That's not to the point. I want cases where the devices staid and did just what was intended. Do you know of any such?

Answer.—Well, when I was at Crofts' they got a big punching machine, which punched six holes at once, and did the work of about four common machines. It worked well and is working yet for all I know.

Third question by Dan.—How many men were discharged at Crofts' when the gang punch went to work?

Answer.—Discharged! Why, none.

Fourth question by Dan.—Please name over such things as you would consider labor-saving arrangements; things which you have seen introduced into boiler shops where you have worked. Give us a fair count.

Answer.—Well, here goes. In the matter of hole work I would mention cold chisels, which will chip three holes without breaking twice, rachet drills which drill more holes than a man can chip, a frame to hold ratchet drill up while you use it. This saves lots of work. A crank drill. This saves. A power drill. This saves lots of work. A punching machine. This saves lots over a drill. A gang punch saves still more. Getting better steel for punches saves lots of labor. Clean marking saves labor. The use of French chalk instead of white chalk saves labor. In cutting out work good chisels compared with bad chisels will let one man do two men's work. A man with a healthy scientific muscle will do the work of two brute force men or two weak men. Oiling a chisel makes it cut faster. A power shear saves lots of work. In handling work crowbars save men, and cranes save still more. In riveting, one gang of two men will do much more than two gangs of one man. This parceling of parties reduces the amount of labor required to do a certain amount of work. Steam and hydraulic riveting will save lots of work.

Fifth question by Dan.—Mr. Mulligan, are you opposed to labor-saving tools in the boiler shop, and if so why?

Answer.—Yes, I am. It takes the bread out of a man's mouth, and as the iron machine don't want the money it earns the boss takes it.

Sixth question by Dan.—In what shops have you been best paid; in shops with every labor-saving device, or in shops where muscle did everything.

Answer.—Well, I never got what I call good pay, but I got the poorest pay in the poorest shops.

Seventh question by Dan.—Did you ever know of a boiler maker being discharged, because a new man was hired who had a big muscle and could do a big day's work?

Answer.—No, never heard of such a thing.

Eighth question by Dan.—Mr. Mulligan, did you ever see, or did you ever hear of a case where the introduction of a labor-saving rig of any kind whatever in a boiler shop resulted in the discharge of a man because the machine did his work?

Answer.—Well, I can't exactly say I ever did, but I have been around some, and I ought to have seen some such case.

Ninth question by Dan.—Mr. Mulligan, what has become of all the boiler makers who have been thrown out of work by sharp chisels, by punching and shearing machines, by bending rules which will run a sheet right through, by riveting machines, by muscle in the arms of other men, &c., &c.

Answer.—Well———. I don't know, I guess they work at something.

Tenth question by Dan.—Don't you guess they work at the boiler maker's trade, and don't you guess there are twenty times as many boiler makers working to-day as there were before riveting machines were invented?

Answer.—I don't know anything about the figures, but I do remember when boiler makers were few and far between. When I was a cub I believe a year's work of all the boiler-makers in the world would not keep the boiler makers of to day busy three hours. It beats the deuce where all the boilers go. It seems as though everybody wants boilers now, and they are so cheap everybody gets them. Trade slackens once in a while, but it used to slacken then ten times worse.

Dan.—Thank you Mr. Mulligan. Your a square chap and a bully boiler maker. Now, Mr. Chairman, all I've got to say is this. I worked in this shop years ago, and I drilled with a ratchet drill every rivet hole made in the place, and three men worked in the shop, and there were not holes enough wanted to keep me busy. The shop now has steady work and pays good wages, and sells boilers so the people can afford to buy. You take the labor saving tools out of the shop and every mother's son of you will tramp but two men, and I will go back to the ratchet, and I bet I can drill more holes than there will be to drill. Labor-saving tools have been a friend to me, and have got you your jobs, and I for one will welcome anything of the kind I see coming along. I move that we tell the bosses to get all the gauge rigs they can use.

* * * Very respectfully,

CHORDAL.

Impediments to Improvement.

The following address was delivered by Prof. John E. Sweet, at the last meeting of the Syracuse Mechanical Association :

Mr President and Fellow Mechanics:

Thirty years ago the 1st of last April I left home to start the life of a mechanic. During all this time, with scarcely an interval, I have been laboring to invent, to design or construct something new, or to improve upon something old. In all the great variety, from the building of barns and sheds to machine tools and the steam engine, not a single thing can scarcely be called to mind that I have worked upon, but what there was a trial to invent, devise, or discover some way to make it better, easier or cheaper. I cannot speak of this experience without frequent use of the personal pronoun, but as people confessing their sins are not usually charged with egotism, I will hazard chronicling my defeats without much fear of being charged with a display of personal aggrandizement. Whether nine out of ten of these attempts at improvement have been failures or not, this is certain, not one in one hundred have been such complete successes as to have been adopted by others.

To devise what we suppose to be an improvement is one thing; to test and prove it is another. To get others to understand and acknowledge the improvement is still another, and a much harder thing. To get them to adopt it is a task or undertaking far beyond the conception of any one who has not spent a lifetime in the experiment. Those who follow in the old track never make any mistakes. Those who are constantly trying to improve, are constantly liable to blunder.

The kinds of impediments to improvement are many. Conservatism, faith in the old way, selfishness, belief that no one can make any improvement except ourselves. All of us have too much of this. Ignorance in those who cannot see the advantages of the improvement, and stupidity, in those who will not. Besides these, there is another impediment which seems to be no one's fault except the inventor's, but exists nevertheless, and that is the experience of the world who have seen us devising so many wonderful things that promised so great but turned out so little. In these marvels, as a general rule, no one is so greatly deceived as the inventors themselves. There is nothing an inventor needs more, receives more of, wants less and is less ready to accept, than advice.

The last thing an inventor wants is some one to help him invent, and there is nothing a true inventor is more willing to do than to help the other fellow out. Improvement does not always imply invention, and the difficulties encountered introducing improved ideas which are not inventions, are greater than the inventions and far greater than the introductions of patents. Twenty-five or thirty years ago the idea possessed me that the usual method of building the foundations of buildings was wrong. I have shown the error, preached, printed and proved the truth of my assertion and the soundness of my principles, but have never succeeded in making but two converts, and one of them is now not living. Architects, builders, carpenters and masons go on erecting large buildings on small foundations, small buildings with large foundations, walls and sills all on one side of the foundations; and so foundations settle, walls fall, ceilings crack, and will to the end of time. One long brace in a building is worth four times as much as a short one; takes but one-half the material and one quarter of the work; still people are going to keep on putting in short braces in their buildings all the same.

Among many of my schemes in machine construction, there have been a number which are matters of general principle and not simply devices for special cases. One is the supporting of machines that are too large to be supported on one single base. A single machine like a drill press can rest on a single plate, and that is the best of all; but in many machines, such as a planing machine or lathe, this is impossible; and I contend that three points of support are better than more, and they are all the supports any ordinary machine ought to have. It is proved that an ordinary planer or lathe can be sprung winding by simply loading the floor upon which it rests. If the machine rested upon three points, such a thing cannot happen. While this principle has been applied with perfect success to lathes, planers and engines, there have been made but two converts among the tool-builders; they were the Pratt & Whitney Company and John Richards.

A second thing, in the way of a matter of principle, is the screwing on wheels like the face plate of a lathe, instead of using a key or set screw. This is the only way they can be put on and have them run true every time. Among those who have the power to control these things, only two are yet converted—Thom and Craig.

Still another point of improvement—equal length sliding surfaces. If two pieces are to slide one against the other, one being short and the other long, the long one will always wear concave and the short one convex. A perfect remedy is to cut off the long one and piece out the short one, until they are of the same length, or approximately the same length, according to the character of the pressure. To this principle, which is as true as any principle in nature, and one that can be carried out in many cases without cost, no converts whatever have been made. Now, what are the impediments to these improvements? Simply these: The old way does well enough; workmen know how to do the old way and do not have to be instructed; machines sell without argument or explanation; and besides, we do not like to adopt the ideas of others if we can help it.

I think it would be possible for steel makers to fit up the proper furnaces, and anneal steel in the bar better and for one-fourth the money it costs the users to do the same work; and as nine-tenths of all the steel used has to be annealed, or should be, before it is worked, it is plain to see what a saving and convenience it would be to buy it already annealed; yet if perfectly annealed steel of the best quality were put upon the market at the same price as hard steel, no merchant or dealer could sell a pound if he had steel of the old shiny sort. Men like to buy by the looks of a thing; though the black gloss on the steel is no more indication of its quality, than the box in which it is packed. Men will not buy a file unless it has an old fashioned tapering tang, and would pronounce any other a fraud, yet there never was a thing made less suited to its purpose.

All machines of whatever character are liable to have something happen to them. If it is an old and well known machine and something happens to it we go on and repair it without a word of complaint; while if the thing is new and anything happens there is no end of complaint and ridicule. If it is an old machine with a new attachment no matter what takes place or to whom the fault is due, the trouble is always laid to the new feature. Then again we know how to run the old machine, we know which journal is liable to run dry, we know which bearing must run loose. We know the old engine pounds but she goes all right and does the business. The new one pounds a little but we don't like it. We wanted to see her run as still as a clock. We have not learned yet how tight she can be run. Screw down on the caps, melt out the babbitt, cut up the shafts and crank, and lay it to the brass strips, or bad brass, or the self-adjusting box, or the new shape, or the high speed, or anything but the true cause. We had not learned how tight the bearings could be run with safety; so in making the next engine we will not put in the brass strips, nor the bad brass, nor the self-adjusting box, nor the new shape, and then if we do not screw down the caps too tight, the new engine runs all right; we shall have proven that the brass strips and the self adjusting box and the new shape were all perfect failures.

In designing the high-speed Steel Mill Engine, I considered there were many difficulties to be met, and used the best knowledge to be obtained on the subject, bestowing a good deal of thought so as to anticipate and overcome the difficulties. Made a half dozen good improvements, one or two of which were not carried out in the right way. The engine goes, however, and with the exception that it is too small (no fault of the inventor) is giving perfect satisfaction. Still, the powers that be, who are building two more engines from the same general design, have taken each and every one of my deep studied improvements and thrown them out.

Letters from Practical Men.

INCORRECT READING OF STEAM GAUGES.

Editor American Machinist:

Having been a steady reader of your most valuable paper ever since the first copy was printed, I feel much indebted to the same for many good practical hints which I have gained, and I feel that it would not be out of place to say just a word or two in regard to the incorrect reading of steam gauges. A few days ago I had a steam gauge brought into the shop for some repairs, and the owner informed me that there was something about it that he could never account for, and that was, after he had the gauge tested, it would not agree with his safety valve, which was a good one and had always worked well, and in a few days after testing the gauge would show from 2½ to 5 lbs. more than the safety valve; also that the index pointer would show that same amount when there was no pressure on the gauge. Now, here was the question: How did the pointer get wrong so soon after the gauge had been tested? This brought the matter home to me, as I had the same trouble with my own gauge, and I

made up my mind to find the cause. After a few experiments and close investigation, I feel confident that I have discovered the cause of all the trouble. 1st. We all know that when the fire goes down and the boiler cools off, there is quite a vacuum on account of the contraction of water and air. 2nd. That very few engineers shut off the gauge from the boiler at nights, and this being the case, of course the gauge must be subjected to the reverse action of this vacuum, which amounts to a deflection of the index pointer from 10° to 12°. Now it is obvious that if the index pointer is not crowded on very tight (which is seldom the case), it will be moved out of place for correct reading. For experiment, let any engineer pull out the zero pin in his steam gauge, let the boiler cool off, and watch the results and see where the index will go. This may be an old and well-known theory to some, but I think it will be of value to many young engineers.

Yours, etc.,

W. S. HARRIS.

Croton Falls, N. Y.

PHILOSOPHY OF THE STEAM WHISTLE.

Editor American Machinist:

I am a constant reader of your valuable paper and have more than once received valuable information through its columns. In your issue of May 15th, F. H. Morse asks for an explanation of the principle of the steam whistle. Having given the subject a great deal of study and labor in my efforts to get up a musical or chime steam whistle, I will give F. H. M. the benefit of my experiments to solve his query. Having set out to produce a single whistle that would give out several tones or sounds simultaneously, the first thing was to find out what produced the sound; whether it was the steam issuing from the circular orifices impinging against the bell, thus causing it to vibrate like a church bell when struck, or whether it was the vibration of the column of air contained in the bell. After considerable experimenting I found that it was not necessary that the bell should vibrate, and that the placing of a metal partition the full length of the bell extending across the diameter, and bracing it solidly to each side did not allow the bell to vibrate, nor did it affect the sound of the whistle in the least. Being partly convinced that the vibration of the air produced the sound, I next built a whistle with the bell divided into three equal compartments, but caused the compartments to be of different lengths. When it was tried with steam pressure I found the whistle produced three separate and distinct tones, thus proving that the vibration of bell had nothing to do with producing the sound, but simply the vibration of the column of air in each compartment.

Yours truly,

Jacksonville, Fla. JOHN EINIG.

Editor American Machinist:

In the interesting description of Professor Sweet's Straight Line engine, published in your issue of May 22, we notice that the inventor claims to be the first to build an engine having the center of its cylinder frame and shaft in the same line and supported at three points.

It may possibly interest some of your readers to learn that eleven years ago our Mr. Skinner built his first engine on this plan, since when our house has been engaged exclusively in the manufacture of this special type of engines, upon which we are glad to have Professor Sweet's indorsement thus late. Yours very truly,

Erie, Pa. SKINNER & WOOD.

COPYING DRAWINGS.

Editor American Machinist:

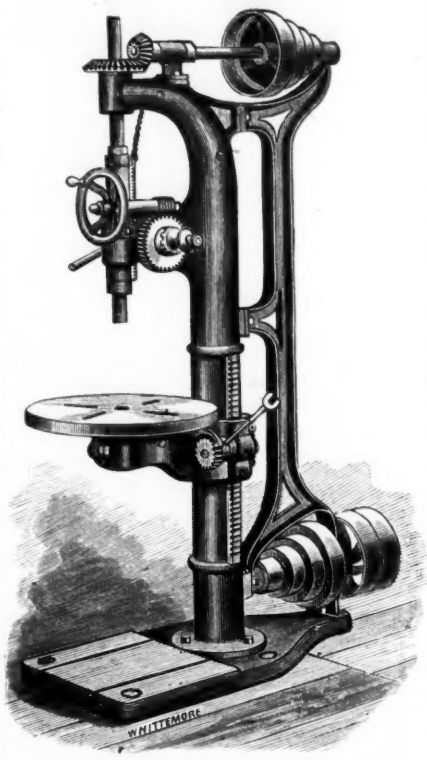
Some time since, I stopped in at the "parson's" to have a little chat with him and get his latest views of "future punishment," "immersion," etc. (If any of your readers have heretofore thought that my acquaintances did not embrace a "guid mon," they will now see their mistake.) I found him operating a new-fangled copying machine, which, I suppose, many of your readers have seen. It consisted of a pad or tablet of composition, similar to printers' roller composition, which transferred writing, etc., in prepared ink from a sheet of paper to itself, and would again transfer a portion of this ink, some fifty to a hundred times, to as many different clean sheets of paper, laid on it, slightly pressed, and immediately removed. The copies were nearly, if not quite, equal in clearness to the original. It struck me that I needed something of that kind for a slightly different nature, so I got a square pan made of zinc, 24×36 inches, with the sides one inch high. Into this I poured a mixture of four parts common glycerine, melted with one part of glue, till the pan was filled ¾ of an inch, skimming the surface of the composition, which had been poured through a piece of gauze, of any remaining scum, etc. The next day it was ready for use. I had a little job which was needed in a hurry, and, ordinarily, I would have had to have made a drawing and three tracings; the drawing for office use and the tracings for the blacksmith, pattern maker, and machinist, all of which would have required time, and the tracings not only be liable to any mistake in the drawing, but also to mistakes in making them.

I made my drawing in the prepared ink, on machine or hot pressed paper, slightly dampened the back of it and laid it face downward on my tablet for about five minutes. I then removed it, and the tablet presented the drawing in equal intensity to the original, which, though it had parted with ink enough for fifty copies, could not be noticed to have changed any, and was as distinct and clear cut as when first finished. I then laid successively five or six sheets of clean paper on the tablet, slightly pressed each one and removed it, each copy occupying about thirty seconds. These copies were nearly equal to the drawing in every respect, being in fact, *fac simi'es* of it. I could have made fifty copies as well as the five or six, which I gave to the pattern makers; and, also one to the foundry foreman, telling him to get his flasks, etc., ready from it. This was new practice to him, but it saved time with no extra trouble or expense.

The secret of the whole thing is in the wonderful diffusiveness of aniline ink, one grain of which I have heard will give a visible tinge to a hogshead of water. The ink is prepared by making a nearly saturated aqueous solution of aniline blue or violet—violet being the strongest. The above in plain "United States" is clean rain water stirred up with nearly all the aniline it will dissolve. I believe the above will be useful to some of your readers, as copies of letters, notices, etc., can be also made. For drawings though, I would suggest the use of a hard paper like Bristol board.

Cold water and a sponge or rag washes the remaining ink from the pad, when no more copies are wanted; then it is ready for business again. If the surface becomes torn or bruised by accident, it can be made as good as new by melting it in the pan, in an oven or otherwise, and allowing it to cool. Unless the ink has been allowed to dry on the drawing for several days, it is not necessary to dampen it, as the pad contains moisture enough if the drawing is applied within a reasonable time. FRANK C. SMITH.

Delaware, O.



NEW UPRIGHT DRILL PRESS.

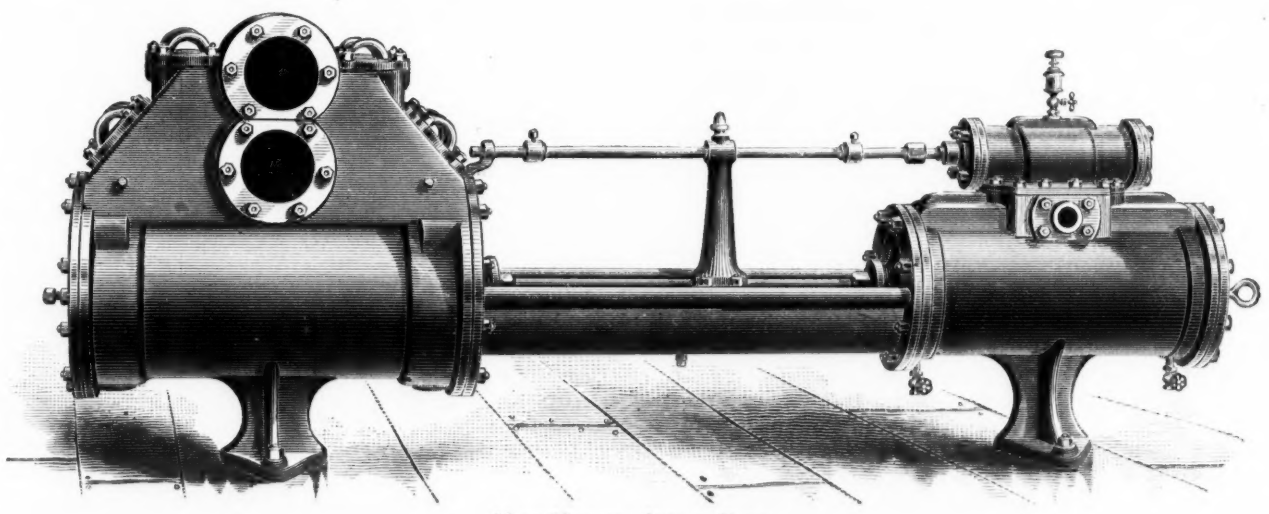
THE CUTTING OF JOURNAL BEARINGS.

Editor American Machinist:

Chordal's articles on bearings are so original and instructive that I hope he will return to the subject again soon, and give us some of the data that he surely must have acquired in exploring this matter. I have a bit of experience with journals working under a pressure that caused heating and cutting, that I wish to contribute to the general fund. The step of a vertical counter shaft for a Daniels planer, gave us no end of trouble by the box in which it ran wearing out sideways. This was cured by cutting a spiral groove around the step, in a direction that lifted the oil to the top of the box, while the shaft was revolving. The oil was returned to a chamber, in bottom of box by an oil hole at the side of the box; in another instance, the front bearing of a lathe, that was cutting while turning some heavy rolls, was saved by cutting two spiral grooves half way around the journal, and in opposite directions. The effect of the grooves is to carry the oil to where it will do the most good. Wm. Sellers & Co. have for years used inclined grooves, in the slides of their planer tables, and in addition to these, a loose piece drops into a groove in the bed, forcing the oil to flow up the inclined grooves.

J. H. PITKIN.

Canton, O., May 17th, 1880.



NEW VACUUM STEAM PUMP.

New Upright Drill Press.

The drill press represented by the accompanying illustration possesses the same general features as the one illustrated in our issue of May 8, 1880, with these exceptions: The head is stationary and the counter shaft which carries the driving-pulleys and cone is located nearer the bed of the machine. This press also has the double column; is designed for a general class of light work, and may be handled with precision and dispatch. It is being introduced by E. P. Bullard, 14 Dey St., New York.

New Vacuum Steam Pump.

One of the engravings shown on this page represents a new vacuum steam pump, which is now being manufactured by the Norwalk Iron Works Company of South Norwalk, Conn. These pumps are designed to be used in connection with marine and stationary engines for producing a vacuum. One of them is said to be in operation on the steamer Natchez, where it produces a vacuum of 28 inches on the steam cylinder, the dimensions of which are 40" diameter by 10 feet stroke. The pressure of steam used is 130 lbs. initial pressure, with valve cutting off at half stroke. The steam cylinder of this pump is 15"x30", and in construction is the same as the regular Earle pump, having the same valve motion, and is manufactured by the firm referred to. The air cylinder is 18"x 30". The workmanship is excellent, and the different parts are interchangeable.

The Massachusetts Charitable Mechanics Association have voted to accept the act of the legislature empowering the association to hold additional real and personal property for the erection of a permanent building. The cost will not exceed $125,000. The site chosen is on Huntington avenue, Boston, and the amount of land purchased will be 110-000 feet.

Among the late arrivals at the Bridgeport, Conn., cutlery shop are three Swedish women, who work in the blacksmith shop. They wear short dresses, stout boots, and do the regular blacksmith work, having been trained to that occupation in their native country.

Engineering, of April 30, date, says:

Mr. E. Vincent is about to proceed from Queensland to England, to arrange for the introduction of sugar machinery for small growers.

The Akron, Ohio, Rubber Works are largely engaged on the Beardmore packing, which is a sheet rubber with cloth in the body.

May 19th over 100 boiler-makers employed on the new grain elevator of the Pennsylvania Railroad Company at Jersey City, demanded from their employer, Mr. Stranus, of Philadelphia, an advance of 25 per cent. in their wages. This was at once refused, and the men stopped work. The strikers threatened not to allow their places to be filled by other men, and a squad of police was sent for to preserve order. In a few hours most of the strikers were willing to return to work, but only a few of them were allowed to return.

Practical Draughting.—Sketching Continued—Drawing on Blackboards.

BY T. P. PEMBERTON.

The sketch book referred to in our last instructions, may be filled with outlines of machine or other work, in short, of anything that the draughtsman may wish to preserve for finished drawings or reference. For instance, he may see a bookcase in a friend's house that is attractive for its good proportions and convenience, or, during some trip, he may see some neat summer house, a conservatory, a boat, or, still again, he may be pleased with the design and proportions of some monument, or ornamental work in wood or stone—these, and such as these, he can sketch and measure, and enter the particulars in his sketch book. From these sketches he is enabled to make drawings to a scale and possibly improve upon the design. At any rate, they are valuable for reference as aids to originating new designs. Whether the aim is to become a professional draughtsman in an engineer's or architect's office, or to become proficient as an amateur in free hand and geometrical drawing, the art of sketching and measuring should receive close and constant attention. By daily practice, the student will be educating both hand and eye, and he will find it a fascinating, a useful and pleasant employment. Besides, he will gather a stock of knowledge and information that will surprise him in its accumulation and its retention in the memory. To draw lines approximately straight and circular is not difficult of attainment.

But besides the sketch book, there is another exercise which should receive attention, and that is drawing on the blackboard. The use of the blackboard for instruction in all subjects of drawing is highly essential. It is now to be found in all academical institutions, in the lecture room, as well as the school room. No draughting office is complete without one; and if the lecturer and teacher find it so invaluable as a means of conveying instruction in a great number of scientific subjects, why should not superintendents, master machinists and foremen use it more generally and frequently than they do in explaining their ideas and "getting out work" for their draughtsmen and workmen? Many a man can chalk out on a blackboard, or a piece of sheet iron, or on the floor, just what he wants to show, but cannot explain verbally, or "to see how it looks full size," who would make sorry work with pencil and paper. We advocate, therefore, a large blackboard in every draughting office, in every pattern, machine and blacksmith shop, for the use of foremen, and superintendents, and customers. We all know that there are a great many things "wanted for once," of which it would be needless to make a paper drawing, and where a pencil or chalk sketch will answer every purpose. Such cases occur every day, in almost every workshop. The readiest, simplest, and plainest way, therefore, is for the superintendent or foreman, or party ordering work, to sketch out "full size," or as near as possible, that he desires to have made. Chalk lines are easily altered and rubbed out when done with. Drawings on blackboards cannot be torn and lost; if properly cared for, they answer, *temporarily*, very well indeed. Now, here are some practical hints for all who use, or intend to use, the blackboard as recommended:

See that the board is entirely free from grease; provide yourself with a pair of blackboard compasses (large wooden ones, that hold crayons), a straight-edge and some chalk crayons. With the compasses you can describe circles and arcs of a circle, and with the straight-edge rule the longer lines. The shorter lines and smaller curves can be filled in by hand. The chalk used for hand work should be *square* in section; square crayons are not so readily obtained as round ones, but they can be made. By a square crayon, a line of uniform width can be more readily obtained, which is difficult, if not impossible, with conical-shaped pieces of chalk. A short stick of wood, about eight inches long, having a cone of four inches altitude and two inches base, its apex at one end of the stick, and its axis the stick itself, the cone to be covered with wash leather, chamois skin, or soft cloth, with a good staple, is the best implement with which to erase lines not wanted; the pointed end of the cone enables the draughtsman to take out constructional or other lines without destroying the curves which are near them. Sponges, chamois skin rubbers, or cloths are used to rub out the drawings on blackboards.

SPECIAL INSTRUCTIONS.

Vertical lines should be drawn from above downwards, thus assisting the eye; the weight of the hand and arm should be alowed to fall naturally. The draughtsman should stand with his right shoulder opposite the vertical line to be drawn. Horizontal lines are made with the greatest facility when a fixed and firm point has been made to the left, and the arm and body moved with the hand from left to right, thus steadying the hand and keeping its position relative to the body the same. In drawing curved lines, it is well, unless the draughtsman has great experience, to make a few dots in the path the curve has to traverse; not more than four or six for any curve, but enough to guide the eye and give confidence to the hand. Passing the chalk-point over the place where the intended curve is to be, without marking, is also useful, as it accustoms the hand and arm to the motion and change of joint required by the curve. Very rapid drawing upon the board is not recommended, because, until the teacher has had great experience it is not likely to be accurate enough. Left curves should be drawn first; and, when drawing the balancing forms on the right hand, the eye should take in, not only the curve in process of formation, but that already made, and to which it is symmetrical. A proper distance from the black board should be kept. The draughtsman will find it better to draw with the whole arm extended from the shoulder-joint than from the elbow or wrist, the face not being nearer the board than a distance of two feet in a perpendicular line to its surface. The diagram should not extend much above the draughtsman's head, for above the head the hand will lose its power; nor below the elbow when the arm hangs at its side, for to draw then brings the head close to the board, and prevents a clear view. If it be necessary that lines be made both above and below these points, the position of the body and head must be raised or lowered, so as to avoid stooping or straining, which is fatal to good work. Drawing on the black board is the most perfect illustration of the expression "free-hand drawing." Practice in this free-hand sketching in the sketch book and on the black-board should alternate with geometrical drawing, of which we will give some illustrations in our next.

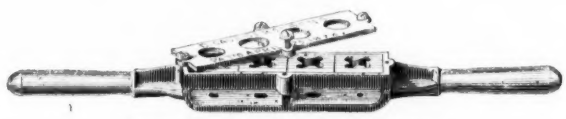
Previous to the current year, the largest number of emigrants from Europe to our country was in 1854, when the records showed 319 000. From this number there was a decline, to 55,000 in 1877. In 1879, the tide in this direction began again, reaching 139,000, and this year promises to reach 400,000.

Improved Pipe Tools.

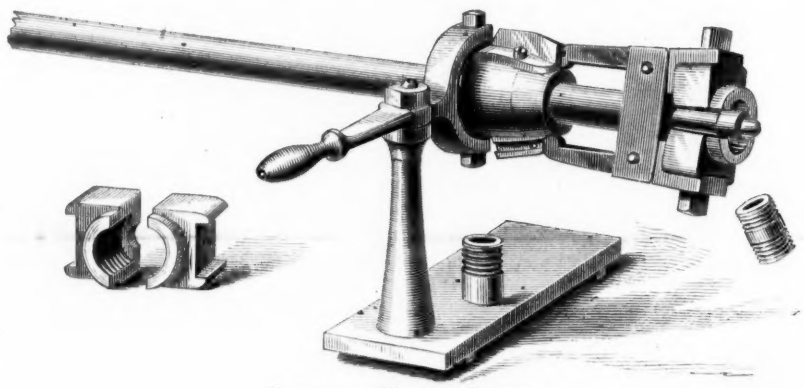
The larger of the engravings on this page represents an improved nipple chuck, adapted to the wants of manufacturers of steam and gas-fitters' supplies. The common mode of threading nipples is by using a solid chuck or coupling corresponding to the size to be cut, which is a tedious, slow and imperfect operation. The difficulties arise from having to use tongs to screw the nipples in and out of the chuck, also from the loss of time in stopping and reversing the machine, and the marring of the thread, and splitting of nipples when short.

This chuck is designed to provide a means of overcoming all these difficulties, whereby the forming of the thread upon the blank or smooth end of the nipple may be performed with very great speed and facility, and without loss of time by stoppage of the machine in putting in or taking out the nipples, as is usual.

The gripping jaw has a set of dogs or chucks, with threads corresponding in size and pitch with the threads upon the nipple. The arrangement is such as insures the meshing of the threads of the jaws with those of the nipples without special care on the part of the operator. An advantage is also given in a novel combination of parts whereby the gripping jaws are quickly and powerfully operated, without stopping the rotating motion of the chuck.



COMBINATION SCREWING STOCK.



IMPROVED NIPPLE CHUCK.

The smaller engraving gives a view of a combination screwing stock devised for steam and gas fitters' use. Two sizes are made; being light, they are easily carried, and are therefore well adapted for work done away from the shop. There are no pieces that will get detached. The dies being loose, the plate can be removed, and left-hand dies inserted when wanted; or when a die is worn out, it can be replaced without replacing the whole set, as becomes necessary with the old solid combination plate.

These tools are manufactured by D. Saunders' Sons, Yonkers, N. Y.

Spontaneous Combustion.

Some experiments made at Riga with reference to the spontaneous combustion of various materials, wadding, raw flax, hemp, the waste from silk, wool and cotton spinning, also sponge, as well as wood most found in cabinet-makers' shops—appears to demonstrate the important fact, among others, that small quantities really take fire sooner than large ones. The substances named were saturated with various fluids—oils, fresh and in a gummy state, turpentine, petroleum, various varnishes, &c. All the fibrous materials took fire when saturated with any of these oils, or with mixtures of the same; sponge and wood dust, on the contrary, proved to be entirely harmless. Combustion ensued most rapidly with seventeen grains of a strong oil varnish—namely, in thirty-seven minutes, while two hundred grains of washed cotton waste, of which a portion was saturated with seven hundred and fifty grains of strong oil varnish and the remainder wrapped about it, required a period of well nigh fourteen hours. On these materials being placed in a well sheltered spot and subjected to a heat of from eighteen to forty deg. C., silk did not flame up, but slowly charred; and, as already mentioned, small quantities seemed to take fire sooner than large.

Machine Designing.

Machine designing naturally divides itself into sections, and these we propose to consider separately.

Principle.—This is the first point to be observed—the designer must not design a machine or piece of work that is absurd in principle. No degree of painstaking will overcome this vital defect. We may define principle as taking care that none of Nature's laws are violated. No matter how well the design or drawing is made, if it is wrong in principle it is useless. For instance, no drawing of a machine, or combination of mechanism, for producing perpetual motion would be of any use. We once knew a water-wheel designed to work a pump, and the pump to work the water-wheel; the water-wheel had a crank on the shaft, the crank was to work the plunger-rod, and the pump was to pump water into a trough above the wheel, this trough conveying the water to the buckets of the water-wheel, and thence the whole cycle was to begin again. The drawing looked very well on paper, and was correct so far as the various parts were concerned, but the principle being wrong, no amount of designing and drawing could overcome the defect. The error was pointed out to the designer, but he would not be convinced; he constructed a model, spent some money in experimenting, but all to no effect. The result was that he became a sadder but a wiser man, for he had discovered that perpetual motion was a breach of one of Nature's laws. Another important point bearing upon the principle of designing machinery is that the action should be continuous, if it does not perform the operation at once. In a steam riveter the stroke of the ram makes the rivet head at one operation; a steam hammer does not accomplish its work at one blow, but the effort is continuous; it repeats the blow until the work is accomplished; there is no undoing of work. We knew an instance in which a machine was designed for bending bars, the preliminary part being to straighten them before the curve was put in; when the bar came out of the machine it was curved, but if not to the required curve, the operation could not be repeated without first straightening the bar again, before any additional curving could be put in. This was a case in which the action was not continuous; the first part of the machine undid what had been done by the latter part. Hence the machine, when made, turned out a complete failure, for want of being designed in accordance with correct principle.

Position.—As soon as we are satisfied that the principle is correct, the important point of position comes to the front. To some extent it may be included in principle, which we have defined to be "taking care that no natural law is violated," for the foundation of position is due to the natural law or axiom that no two things can be in the same place at the same time. This is more important to bear in mind when designing moving machinery. A drawing only shows one position of a moving part; hence, unless there is great care on the part of the draughtsman in following out the motion of each part to its full extent, he is liable to have some parts foul one another when they have moved into a new position not shown on the drawing. To some extent this may be avoided by making diagrams showing successive phases of the moving parts, but this involves a great deal of work, and is often neglected. It is desirable, when possible, to show the parts in the worst possible position in relation to each other. Very frequently the extreme phase of one part does not coincide with the extreme phase of another, as in the steam engine the valve is not at full stroke at the same time as the

piston. To get over this difficulty, it is very customary to make a working drawing disjointed—that is to say, the various parts are drawn as if they were all in their worst position at once, it being understood that this is only a convention, in order that the various parts may be in their proper position in all phases of the machine, for if everything clears in its worst positions it naturally clears in every other position. In spite of all drawings, however, errors will arise, and the constant care of the draughtsman should always be directed to the point technically called clearance.

It should also be borne in mind that not only have the parts to work when they are together, but that they have to be put together; there should be no collars, for instance, on a shaft to prevent a wheel being slipped endways. Putting work together is naturally an extension of position in relation to moving parts, for the parts are moved, although but seldom, viz., when the machine is put together or pulled to pieces. Whilst considering this point it is well to mention bolts and nuts; the designer should take care that they are arranged where they can be put in, and where the nuts can be put on and taken off. This is a small point, but is one frequently overlooked by draughtsmen, who often show work as if the bolts and other minor parts had grown, it being impossible to get the work together as shown on their drawing.

Strength.—After principle and position, strength may be considered the next factor. This is a matter primarily of calculation, and secondly of precedent, it being well known that if a part of a machine was strong enough in some other machine, or under similar circumstances, it is strong enough for the case under consideration. The strength of materials, and parts of machines, would require a volume to itself, and it is not our intention to dwell upon it. It is important that the designer should be a good calculator, well up in theory, and also that he should have had a good deal of practice, or, in other words, a good store of precedents, which is only theory embodied in practice. Particular care should be taken that no sudden changes occur in the dimensions of bars, axles, and other parts, and also that there should be no internal sharp corners to any of the castings. These are great pitfalls to the unwary, and care should be taken in avoiding them.

Proportions.—The vital points of principle, position and strength being supposed to be settled, there remain what may be considered the luxurious points of pleasing proportions and of ornamentation. Elegance of proportion is more a matter of fancy than anything else, and can only be acquired by practice. There are generally various ways of drawing and arranging the parts of a machine without violating any of the vital points we have already dwelt upon. The draughtsman will do well to think to himself as he goes along: Does this look well? Will it look better in any other way?

Ornamentation in machinery is generally the addition of a few mouldings, scrolls, and such like, which, as in proportion, is a matter of taste or feeling. Care should be taken to avoid contradiction in ornament; there should be a similarity of style about the mouldings, the scrolls, and the shapes of the subordinate parts of the machinery.

It must be understood that all the points into which this article is divided must be considered by the designer simultaneously; they cannot be separated when designing, as we have done here for the convenience of treatment, and in relation to the importance of the divisions.—*Design and Work.*

The Port Jervis *Gazette* says that a cow that wore a bell having been run over and killed on a railroad, the owner brought suit against the railroad company for damages. It was proved that the engineer rang the bell and tried to frighten the cow off the track, but the farmer's cow also rang her bell and tried to frighten the engine off the track, and so the jury decided in favor of the farmer.

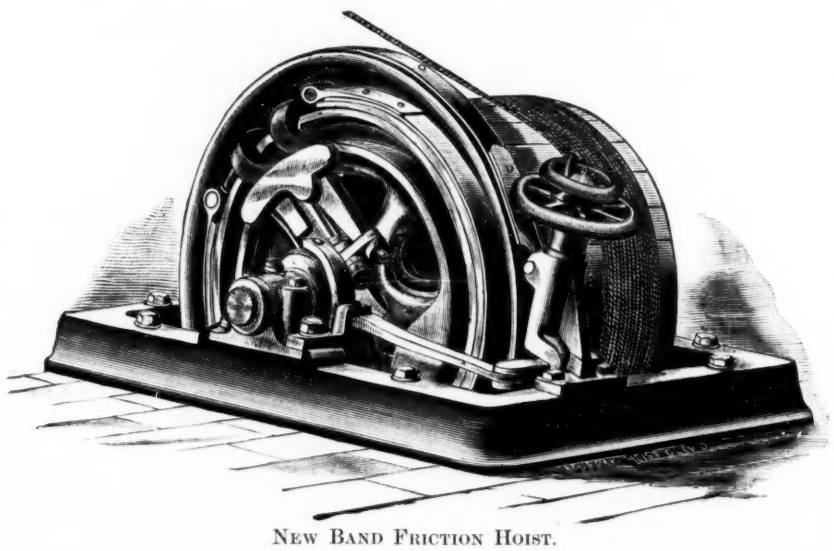
Improved Band Friction Hoist.

The accompanying illustration represents an improvement in the application of power to "Hoisting Drums."

The drum and engine shafts are connected by a gear and pinion not shown in cut, the drum being loose on its shaft. What is known as the "band brake," that is, a band of iron lined with wood and extending nearly around a drum, has long been used for slowing, stopping and holding a load, and has proven the best device known for that purpose.

In the cut are shown two bands, the outer one being the brake which is operated directly by a double thread screw connected with the small hand wheel. The inner or driving band is made to revolve around a flange on the drum head, being attached at each end to arms carried by a driving disk which is keyed fast to shaft. One of these arms is fixed, while the other forms a lever to tighten the band, being connected by simple mechanism with the large hand wheel. Although the two hand wheels can be used—each independent of the other—they are usually locked together by a novel differential device, so that the operator has only to handle one, as one band automatically tightens as the other becomes slack.

The drum is started gradually without the least jar or shock, thus being easy on foundations, machinery, sheaves and cages on car, as well as the rope. The load may be slowed near the top, and thus stopped at the exact point without jar. The advantage of this method of applying the power upon the periphery of the drum is in the reduced friction and consequent saving of power, there being simply the friction of two journals of the drum shaft.



NEW BAND FRICTION HOIST.

Any number of these drums may be used upon the same shaft, each being operated entirely independent of the others while the engine is at all times running at full speed in the same direction and controlled by the same governor, whereby the full power of the engine is realized upon the load to be raised.

The cut shows drum for hoisting with single rope, but the improvement is also used for hoisting with two ropes with double or balance cages, by using two driving disks, connected with drum by gearing, there being no reversing or slowing of the engine.

The same driving device without the drum is also used for a friction clutch, for which purpose it has proved exceedingly powerful, simple and durable.

These hoisting drums are patented and manufactured by The Webster Camp and Lane Machine Company of Akron, Ohio. Several of them are in use, giving the highest satisfaction.

Twenty-two locomotives were shipped from the Paterson shops during the month of April, which is doing well considering the state of affairs at the Danforth Works in consequence of the fire.

The new Quincy, Ill., paper mill will be in operation by July 1.

The Metric System.

BY WM. KENT, M. E.

(Extracts from a paper read before the Engineers' Society of Western Pennsylvania, March 20, 1880.)

There are two societies (if not more) in the United States, whose especial object is the introduction of the metric system in this country, viz.: The American Metrological Society, in New York, and the American Metric Bureau in Boston. They are both doing their best to establish a propaganda of the system. One issues a monthly bulletin containing much valuable information. The other, when last heard from, was circulating a petition in favor of the speedy adoption of the new system to be presented to Congress. At the risk of offending my friends in these societies I must here criticise their methods in part, and offer them a word or two of unasked-for advice.

First.—The metric system, if it is ever adopted in this country, must be made more simple than it is, for the easy comprehension of the common people. The American Metric Bureau publishes a list of the metric denominations, containing not less than forty terms. The whole number of terms used in the English system is only about eighty, and many of these are scarcely ever used. I present herewith a revised table of the metric system, which, I think, will commend itself as being much better in every way than the tables generally published. It contains only fourteen denominations:

MEASURES OF LENGTH.

Millimeter (mm)=0.039371 inch.
Meter (m)=1000 mm=39.370794 inches.
Kilometer (km)=1000 m=0.62138 mile.

MEASURES OF WEIGHT.

Milligram (mg)=0.015432 grains.
Gram (g)=1000 mg=15.43234874 grains.
Kilogram (kg)=1000 g=2.24062 lbs. avoir.
Ton (t)=1000 kg=2204.62 lbs. avoir.

MEASURES OF SURFACE.

Sq. decimeter (sq. dm)=15.50059 sq. inches
Sq. meter (sq. m) 100 sq. dm=10.7643 sq. ft.
Hektar (hk)=10,000 sq. m=2.47114 acres.
Sq. kilometer (sq. km)=100 hk=247.113 acres.

MEASURES OF CAPACITY.

Cubic centimeter (cu. cm)=0.06103 cu. inch.
Cubic decimeter or liter (cu. dm. or 1)=1000 cu. cm=61.02705 cu. inches=1.0567 quarts.
Cubic meter (cu. m)=1000 liters=35.31658 cu. ft.

This table would do away with the objectionable prefixes, centi, deci, deka, hekto, myria, and would use only the prefixes mili and kilo for all measures of length and weight. The very perfection of a system of measuring is probably that of expressing a length or a weight in one denomination only. This the table enables us to do. The engineer or machinist could use the millimeter only for all short lengths, say less than a meter. For all lengths varying from a meter to a kilometer, the meter and decimals of a meter only would be used, and the dimension would be read so many meters and so many tenths, hundredths or thousandths, according as one or two or three places of decimals were used. Surveyors would use the kilometer and tenths, hundredths and thousandths of a kilometer. Likewise with the measures of weight—the chemist and the physician would use the milligramme for all weights less than one gramme. For weights over one gram, the gram and decimals of a gram would be used. The grocer would use the kilogram and decimals of a kilogram only. The coal and iron merchant would use the ton and decimals of a ton. The astronomer, if he wished to express the weight of a planet, would use the ton also, even to millions of millions, so that there is no conceivable weight which might not be easily and satisfactorily expressed by one out of only four denominations. The American money table has the denominations eagles, dollars, dimes, cents and mills, but practically the dollar and the cent denominations are all that are necessary. The largest possible sum of money can be expressed in dollars and decimals of a dollar, and the smallest possible amount in fractions of a cent. The term mill is used in tax ratings, but everybody would be satisfied if this term was abolished, and tenths or hundredths of a cent substituted, as is done in the price lists of the iron trade. So the useless denominations of the metric system should be abolished, and if the advocates of the metric system would hasten the adoption of their pet they should remove this great objection to it.

The second piece of advice I would give to the advocates of the metric system is—do not try to make us swallow the whole system at one dose, but give it in small quantities at a time. Attack us in our most vulnerable point—say the gross and net and half a dozen other kinds of tons, and leave our foot and inch, our stronghold, alone. "Divide and conquer," as the free traders are trying to do with the protectionists. Suppose, instead of trying either to get a law passed to make the whole metric system compulsory at once after a certain date, or even trying to get public opinion to favor such a law at any future time, you do try to get a law passed introducing one little bit of the metric system first, and then follow it up with others if the first attack is successful. If you would only attack the various kinds of *tons*, you might do a great deal of good with a minimum amount of injury to anybody. Say that the legal ton hereafter shall be not 2000 lbs., 2240, 2268, 2284, 2352, or any other number of pounds now used in any trade, but 2204 62-100 pounds, and punish heavily any one who should use any other ton (especially the retail coal dealer, who should use 1600 or 1800 pounds) and make the legal subdivision of the ton a decimal one into one thousandth parts, and you would have an important part of the metric system introduced with the least friction. Or you might try the quart as your first point of attack, and slightly change its volume (5 per cent. and a little over), and you could have the French liter. You might then abolish the bushel, and for large measures of bulk substitute the 1000 liter measure, or cubic meter, containing about four-fifths of a chaldron. But not till all of these changes have been successfully accomplished need you ever hope to abolish this little instrument, which is in the hands of a million American mechanics to-day—the two-foot rule. Yes, first establish an international money system, successfully accomplish the reform in the spelling of the English language, teach all the nations of the earth to speak one universal language, or do any other desirable but Herculean labor which finds its chief hindrance in the habits, traditions and prejudices of millions of the human race, and you may be prepared to undertake such a revolution as would be the substitution of the meter for the two-foot rule.

That such a change in the system of measuring lengths has been accomplished in other countries is not a conclusive argument that it may be accomplished in England and America. In France, at the time of the adoption of the metric system, change was the order of the day. The people changed everything that could be changed, whether material, mental, moral or spiritual. How easy then to change their measures. In Ger-

many the adoption of the metric system was only a welcome relief from the total confusion previously existing, when every little state had its own measures. In other countries which have adopted it, the manufacturers and mechanics, the people who use measures of lengths formed such a small portion of the population that their opposition to the new system, if they even were educated enough to make that opposition an intelligent one, was too feeble to cause any trouble. But in England and America the case is a different one. Here are the two great manufacturing nations of the world, including, with the colonies of England, nearly a hundred millions of people speaking the English language, possessing a standard of length as absolute and invariable as the French meter. Each of these two nations probably does more measuring than all the rest of the world put together. There are probably more two-foot rules in use in the world than all the meters, and all the other measures of length of every kind whatever combined. And the users of these two-foot rules are the most conservative and stubborn people on the face of the earth, and they will resist the substitution of the meter to the last extremity. Therefore I say to the advocates of the metric system, leave the two-foot rule alone. Confine your bulletins and your petitions for the next half century to the advocacy of the adoption of the French systems of weights and measures of capacity only. If you will change the measure of length, change the yard-stick first, and make every man who stands behind a counter selling tape and ribbons sell them by the meter and its decimal divisions, but leave the engineer alone. The foot and the inch are the measures he believes in. For long measures he will use the mile and its subdivisions, either into tenths or into feet. For very short measurements, such as one of our members uses in measuring the elongation of a test piece, he will use a micrometer screw with divisions reading to the ten-thousandth part of an inch.

If my hearers now think that I have only "straddled" this question, and not planted myself as firmly as they could wish on one side or the other, I will now define my position. I think that theoretically the metric system is a very good system. Practically it is practicable in some things, impracticable in others. In regard to government interference I hold about the position of Ensign Stebbins on the Maine liquor law: He was in favor of the law but opposed to its enforcement.

The Totophone.

This ingenious and scientific instrument is the invention of Prof. Alfred M. Mayer, Ph. D., of the Stevens Institute, Hoboken. It was designed to determine the direction from which a sound proceeds either at night or in foggy weather, and is of special interest to the navigator in locating fog signals. In addition to the above useful applications, the totophone can also be used in various experiments in the science of acoustics. The accompanying engraving, Fig. 1, represents this instrument in operation as applied to the deck or cabin of a vessel. The instrument consists of two resonators or sound receivers *A* and *B*, which are made adjustable upon a suitable bar or support *R*. This bar is supported by the vertical spindle or shaft *S*, the lower end of which is pivoted upon a dial or graduated circular plate *P*. By means of the handle *N*, the resonators may be turned to any point of the compass. Two elastic tubes *D* and *E*, are connected with the resonators, and, passing through the deck, terminate in a single adjustable tube *E E' G*, as shown. This tube connects by means of the single tube *I*, with a pair of ear tubes *L* and *K*, as shown, attached to the ears of the operator. The principle upon which this instrument operates may be better understood by referring to Fig. 2, where *S* represents the source of a sound and the circle a wave surface produced by that sound. On this surface all the molecules of air have at the same instant the same direction and the same velocity of vibratory motion. If we can accurately determine two points *R R'*, on this wave-surface, and this wave-surface be a spherical one, that is, be not deformed, then a perpendicular *C S*, erected to the center of a chord drawn between these two points will when produced pass through the source *S*. The method consists in determining these two points on a sonorous wave-surface as follows. Let *R R'* be two resonators accurately tuned to the note given by the vibratory body at *S*. Suppose both resonators at the same instant on the wave-surface, then they both receive at the same instant the same phase of vibration on the plates of their mouths. If two tubes of equal length lead from the resonators and join into one tube just before they reach the ear *E*, then the sound-pulses will act together being of the same phase, and the ear will receive double the action which it would if only one

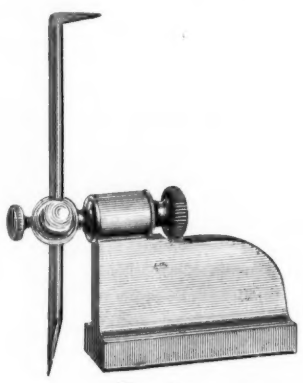
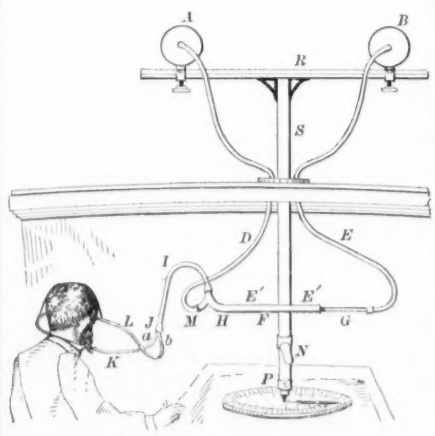


FIG. 1.

resonator were connected with the ear. But suppose that one of these tubes *T'*, differs in length from the other tube *T*, by one-half of a wave-length of the tone given out by *S*, then the same pulses will no longer work together at *E*, but will be opposed to each other in their action, neutralizing each other's dynamic effect, and producing silence at the ear *E*. This last condition is the one used in the apparatus above described.

We connect the two resonators *R R'*, by a rigid rod, and it is evident if a pointer be placed at the center of this rod and at right angles to its length, that when the resonators *R R'*, are on the wave-surface, the rod *C S*, will point toward the source of sound at S. The rigid rod connecting the resonators *R R'*, turns on a vertical rod passing through *C*.



TOTOPHONE.—FIG. 1.

In a test which was made last year by Prof. Morton in company with the inventor and others it was found that the direction from whence a sound proceeded could be determined within one point of the true direction or within 10° which is exceeding close for all practical purposes.

It is the honest "plodding" workman who rises to an elevated position in the world. Work is, as a rule, at the foundation of all true success. Brilliant parts, fine education, powerful friends are not to be despised, but they cannot supply the place of personal toil and patient painstaking industry. President Lincoln literally worked his way up from a common laborer to the highest position in the gift of the Republic. Henry Wilson, at twenty-one, carried his wardrobe and library on his back whither he went in pursuit of work. Commodore Vanderbilt laid the foundation of his vast fortune in the savings and habits of industry acquired in his young days in rowing a ferryboat. Charles Dickens owed his success not more to his genius than to hard systematic labor.

A Useful Combination Gauge.

The accompanying illustrations represent a very useful combination gauge for machinists and other mechanics. This gauge, as shown in Fig. 1, can be used as a surface gauge which is capable of being set with great accuracy in any position, and is not liable to move when once adjusted. In this form it can also be used to find the centers of pieces of lathe work. Place the gauge upon a surface plate, bring the piece to be centered in contact with the scratch, and by turning the piece of work in different positions, the true center may readily be determined, thus

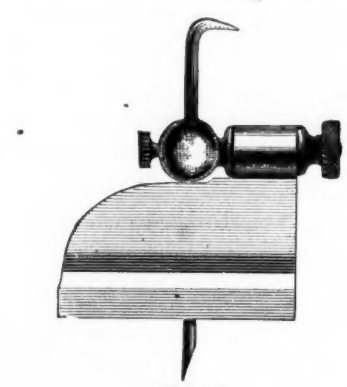
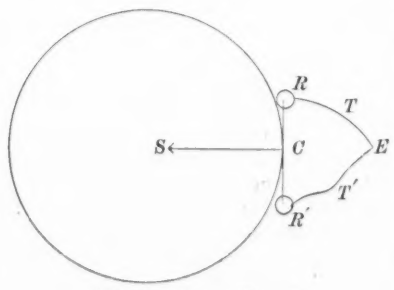


FIG. 2.

saving the tedious process of revolving the work upon centers. The same gauge may be used to measure the depth of holes, teeth of wheels and key ways, by unscrewing the binding nut, reversing the barrel and placing the pointer through the hole, thus making a tool which will be appreciated where perfect accuracy is indispensable, such as dovetailing and fitting slide rests.

Should the depth be measured the pointer may be replaced by a piece of Stubbs wire. By reversing the pointer so that the hook will be where the pointer is shown in Fig. 2 this tool may be used as a scratch gauge, and is adapted to the work of engravers, tool makers and die sinkers. These advantages will readily be seen by those who have been accustomed to use the old fashioned fathom which is so liable to change its position when in use. When this gauge is set it is firmly held by the screw, so that there is little if any danger of alteration. They are carefully made, case-hardened and nickel-plated. The pointers are made of Stubbs steel wire and tempered, and are well calculated to give the best results. These gauges are sold by Peter A Frasse & Co., 95 Fulton street, New York.



TOTOPHONE —FIG. 2.

By a private letter received from his son, Mr. Geo. Richards, of Philadelphia, we learn that the reported death of Mr. John Richards, the well-known engineer, as announced in our issue of March 6 last, was unfounded in fact. Mr. Richards is yet living, though in uncertain health and retired from active pursuits for a time.

The belting required for Mowbray's new flouring mill at Winona, Minn., is a very important item, and may be better understood by the general reader when he is informed that the total amount of belting will be over three miles in length and cost over $5,000.

A New Hydraulic Cement.

A late issue of *Engineering* gives some particulars about the discovery of a method of making a high quality of hydraulic cement, by Mr. Frederick Ransome, in which the slag sand from the blast furnaces forms the chief ingredient. The discovery seems to be a very important one, as the product has proved superior to Portland cement, and is made mainly from a waste material which is abundant in the United States as well as in Great Britain.

We make some extracts from the article in *Engineering:*

Good Portland cement, which now enters so largely into the construction of all hydraulic and substantial building operations, is, as our readers are aware, a compound of silicate of lime and alumina, and contains about:

	Per cent.
Lime	62
Silica	22
Alumina	8
Oxide iron	3
Potash, soda, magnesia, &c	5
	100

This composition is generally obtained by intimately mixing chalk and clay, this mixture being burnt at a very high temperature into an extremely hard clinker, which is subsequently ground to a fine powder. Mr. Ransome having been applied to, to produce a cement possessing the strength and valuable hydraulic properties of Portland cement, was not slow to appreciate, and avail himself of, the valuable results obtainable by a combination of the slag sand from the blast furnaces with an additional quantity of lime. He at once commenced a series of experiments, and, succeeded in producing a cement of a most delicate color, possessing extraordinary hydraulic powers, and acquiring great strength, increasing with age. Thus at three days it was stronger than Portland cement at seven days: in seven days it was stronger than Portland cement at three months; at fifteen days it was stronger than Portland cement at twelve months; and at twenty-eight days it was stronger than Portland cement at seven years. The foregoing results were obtained by mixing the slag sand, supplied by the Tees Iron Company, with the white chalk of Essex, in the proportion of about 1 ton of slag sand to 1¾ tons of chalk, and subsequently burning the same in ordinary cement kiln. The composition of the slag sand above alluded to was, as stated in our former notice found by analysis to be:

Silica	38.20
Alumina	22.19
Lime	31.56
Magnesia	4 14
Calcic sulphide	2.95
Protoxide iron, &c	.91

Mr. Ransome has, however, ascertained that he is able to obtain a still stronger cement by the employment of slags containing a higher percentage of alumina. It was long since discovered and reported by M. Fremy and MM. Rivot and Chatony in their admirable works on cements, "That aluminate of lime is the principal hydraulic agent in cements." M. Fremy attributes the setting of a hydraulic cement to two chemical actions: (1) to the hydration of aluminates of lime, and (2) to the action of hydrate of lime upon the silicate of lime and the silicate of alumina and lime which exist in all cements, and in this case act as puzzolanas. The results arrived at by Mr. Ransome fully corroborate these views, and by attaching full importance to the presence of alumina, Mr. Ransome has, as we have mentioned, succeeded in greatly increasing the strength of the new cement. Samples which we have seen show remarkable hardness and closeness, and the material in fact promises to be an exceedingly valuable one. By the employment of blast furnace slag sand, the great proportion of the expense involved in the production of the clinkers used in the ordinary process of manufacturing cement is avoided; the cost of fuel and expense of grinding being hence reduced, while a useful application is found for what has been until recently a waste product. The Ransome cement as made from the blast furnace slag sand, without the admixture of any coloring matter, is of an exceedingly pleasant tint, while any desired color can be given to it as desired by the addition of suitable coloring materials. Altogether Mr. Ransome may be said to have created a new branch of industry of value alike to engineers, architects, ironmasters, and cement makers, and we are not surprised to learn that he is meeting with the co-operation of many of our leading men interested both in our iron and cement manufacture.

The Elgin Watch Factory, Elgin, Ill., has lately increased the number of its employes from 600 to 1,100, and the factory is now turning out 600 watches daily.

Quaker Capital and Labor.

Rev. Robert Collyer, in his recent lecture on "Capital and Labor," speaking of the early struggles of "Friend" Jacob Bright, whose business at Rochdale, England, has been so deservedly famous for fifty years, said:

"Friend Bright could not be content to serve now; he was looking out for a chance to employ and create. And you may feel pretty sure that when a young man has it in him to do this to a good purpose, there are those somewhere who will lend him a lift. Jacob got his lift in Manchester, where a few gentlemen with money and brains had been watching him as he did business with them. One, or perhaps two, factories had been started in the valley of the Roche, which is now so full of them, and one of these was waiting for Friend Bright; and so he became an employer of labor, and his business in this world was to spin honest cotton thread.

"Now there were two ways open to Friend Bright—as there are to most employers—of conducting this business. The one was that they should come together, each bent wholly on his own interests, but with no regard beyond this for the interests of the other; conclude a sort of armed truce which each side might break at its own convenience, the employer getting as much work as he can out of each hand for the least money he will take; the employed giving the least on his part and getting the most, and each going his way when the workshop or factory closes for the day, and caring no more for each other than if they lived in Chippewa and China.

This was one way, the other was that the man with a great brain and the fine powers which lead to fortune should nourish a genuine regard for those who were under him, as so many brothers and friends of poorer endowment, and so win their regard if he could in return; count his fortune with the power to make it as a trust to be held, in some fair measure, for those through whose toil, as well as through his own, the wealth and power is won. And this was the way Friend Bright took, at once, with those who came to work in his factory, and with his poor neighbors and friends in the town. * * *

These mill hands, in those days, were born to a hard lot, and were growing up ignorant and base under the new state of things which had come with the factories. Martha got the young women together twice a week and gave them due and sound instruction. It was all she could do as yet, for her means were limited and she had to keep the books for Jacob. Besides this, there was that steady knitting of stockings for her own and other people's children which seems to be a part of "Friends'" devotion. And as she taught she raised her daughters to teach. She got the hands together in the mill and put a needle into their fingers and a pen and books, and showed them their fine uses, and so kept on until at last a capital school was built up and manned in connection with the factory, and no child need go into the world ignorant while the spindles turned in the hands of Jacob Bright.

* * * * * *

Nor was Friend Jacob apt to lag behind the good wife in such tender and thoughtful care. When the factory closed winter nights and the children had to pick their way home through the dark lanes, there was Jacob at the gates with a lantern, putting so many in charge of each trusty man to see them home. And as he went up and down his mill, if he heard a child cough, out came a certain confection sovereign for a cough, and very good to take; and this was administered with no sparing, on the spot. How many little rogues invented the cough for the sake of the confection it would not do to inquire, and here my chronicle is silent.

It was the custom within my day for the overseer to carry a strap—a length of leather exactly like that which barbers' use; and this was laid well and with emphasis across the shoulders of any child who did not keep up with the rest; and many a time I have been so smitten. "No strap here!" Friend Bright said. "No flogging—only moral suasion;" and the moral suasion lay in another "Friend," who was very clever at such work. They would marry these young folks when their time came; there was no defence in the machines against that. But Friend Bright would say: "Thee is a married man now; thee will need more wages; I will give thee more." He might be worth no more than the young bachelor who was working at his side; but the kindly heart was aware of a time when all the way round by Bolton was the only way to Rochdale.

* * * * * * *

When sickness or old age overtook a workman who had striven well but lost the battle, and had nothing to depend on, he was pensioned handsomely for life. But Jacob was so generous in his payments that very few who worked for him failed to have a competence by the time when they could work no more, saying to himself, no doubt, if I make one they would make one also; it is simply a question of degrees.

* * * * * * *

Now the proper conclusion to the career of this Quixotic Quaker would be to break and pay nothing at all in the pound, to find his heart as hard as the nether millstone through being perpetually taken in by those he had tried to help; and to leave those ten children a fine legacy of scorn and contempt for the working classes, caught through his steady fire-side talk of their treachery and greed. But the truth is he grew rich, somehow, in despite of all the Gradgrinds in Lancashire who might laugh at him; so that in time he had 40,000 spindles whirling in four great factories, and a great host of people working for him, who looked on him as a father and a brother; and his great son was able to say, many years ago, that with one slight exception there had never been a break or a jar between the family of which his father was the head, and their great host, in fifty-seven years, no strikes, nor breaking of machinery, nor burning of mills—nothing but peace and good will for almost two generations.

* * * * * * * *

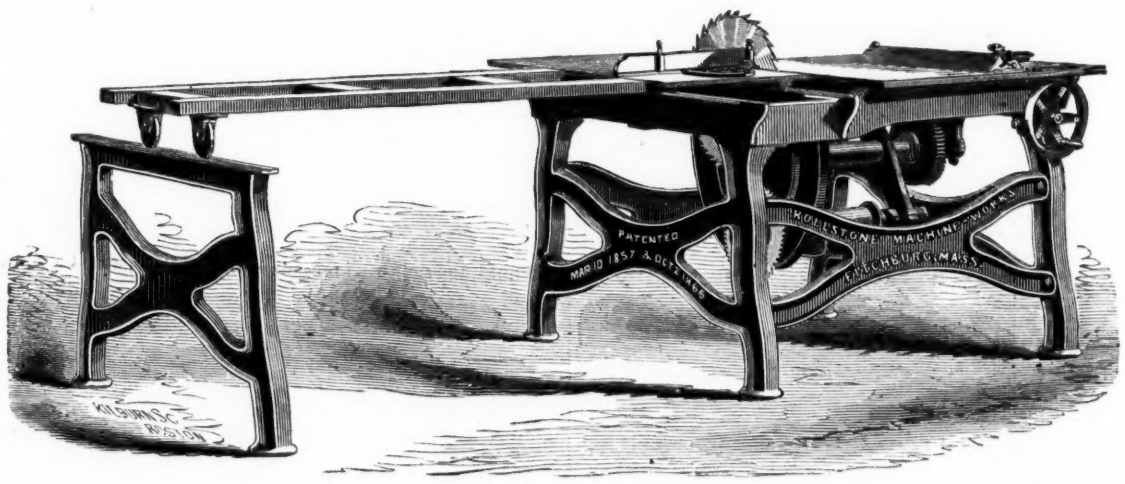
Who should take the first step? The employed cannot take it; the employer can. It rests with the great brain; with the man who is in his degree a king, who can say to this man go and he goeth, and to that man come and he cometh. The human heart will still answer to the human touch; and if you draw near to those who work for you, they will draw near to you. I do not want to stand in that man's shoes who makes a great fortune in this utter indifference to those whom he employs, and then leaves a hundred thousand dollars to build churches. Better spend it in a thousand gracious ways among those nearest while you live, for this last word touches the nerve which is so pained by these perpetual jars between capital and labor.

A Convenient Saw Table.

The saw table illustrated on this page is one of the most convenient of its class. The machine carries two saws each upon a separate arbor. These are both placed upon a frame which rotates about a central axis which enables the saws to be changed, one for the other, at will and firmly held in any desired position. The position of the saws is regulated by the hand wheel seen on the front of the frame.

The left-hand side of the table slides on tracks and carries a rest, which permits it to be set for accurately sawing an octagon, hexagon, square or miter by means of pins and corresponding holes in the table; and quite as readily adjusted for accurately sawing to any desired angle by means of a graduated arc divided and marked into degrees, over which the cutting-off fence swings and is fastened at pleasure. The splitting fence, carried on the right-hand part of the table and sweeping its full width, can also be adjusted to split any angle from a square to a miter.

One desirable attachment to the machine is for cutting out circular forms. The machine shown in the engraving is for shops where very heavy work is required. The table is 51 inches square and carries two saws from 12 to 16 inches diameter or a single saw of any size up to 26 inches. It has an extension table, as shown, which gives it large capacity. The manufacturers are the Rollstone Machine Co., Fitchburg, Mass.



SAW TABLE.

Removing Railway Earthwork by Hydraulics.

The methods of hydraulic mining have been employed with great success in clearing away the heavy slides of earth which occurred recently on the Central Pacific railway above Alta. The mass of earth was so great, and the difficulty of handling it in the ordinary way so formidable, that, unless water had been resorted to, several weeks might have elapsed before the track was cleared. But the hydraulic miners were called upon for help, and they found the situation one which presented no perplexities to them. They brought up their pipes and monitors, constructed a flume from a ditch which was fortunately near at hand, and in fourteen hours piped away a body of debris which had been the despair of picks and shovels. The tremendous power of hydraulic mining methods has been here exhibited in a very practical way, and for the benefit of the community. Those who witnessed the swift dispatch of this avalanche of earth have attained a lively perception of the effects produced upon the bluffs which contain the gravel deposits. It is, indeed, somewhat singular that the hydraulic monitor has never, so far as we are aware, been used in making cuts on railroads where the soil is sufficiently soft to be piped. It might be thought that in such cases there would be great economy in the application of water power, for a strong head of water, directed by an experienced hand, will cut out and carry away more dirt in one day than fifty men could shovel and pick in a week. The slide at Alta would have undoubtedly delayed the resumption of railroad travel very much longer, but for the happy thought of enlisting the monitors and little giants in the work of clearing the track. —*Sacramento (Cal.) Union.*

LITERARY NOTES.

WORKSHOP RECEIPTS FOR THE USE OF MANUFACTURERS, MECHANICS AND SCIENTIFIC AMATEURS. By Ernest Spon; 450 pages, 8vo. Price, $2.00. Published by E. & F. N. Spon, 446 Broome St., New York.

The book bearing the above title has been recently issued, having a new title page and a binding which makes this publication more ornamental. It has also been corrected, thereby rendering it more useful. The object of the author when first publishing this book was to furnish to amateurs, and others interested in scientific pursuits, with a ready book of reference for processes which are of a thoroughly practical character. It frequently happens that a mechanic has to perform some duty which requires a knowledge which is foreign to his usual avocation, and he requires an instructor. The object of this book is to supply such a demand, and will probably fully meet the desires of the artists, mechanics, and manufacturers, making their several trades and professions more pleasant and remunerative. The author claims this to be a reliable handbook in all the branches represented, for the reason that most of the receipts have been taken from practice while the others have been verified by good authority. By exercising these precautions, it has been rendered of special value, covering most of the technological, as well as practical pursuits. We commend this book to our readers as being one worthy of careful study, and practical adaptation.

Operating Elevated Railroads by Electricity.

The Council of Magistrates of the city of Berlin have appointed a special committee of engineers and architects to examine into, and report upon, the proposal submitted by Siemens and Halske for the construction of an electric railway across a portion of the capital. It is intended to begin the line at Belle Alliance place and run it through Friedrich and Chaussee streets on to Wedding place. The tracks—one for the up and the other for the down trains—will be supported by iron columns, 14 feet 9 inches high and 33 feet apart. The carriages are to be narrow and short, having only ten sitting and four standing places. The electro-dynamic machine to move the train will be placed under the floor of the carriage between the wheels, and a steam engine of sixty horse power to produce the electricity will be placed at the terminus. There will not be many stoppages, and the rate of speed is estimated at about twenty miles an hour.

When babbitt metal cannot be readily obtained, a small portion of antimony, mixed with lead, produces a substitute that can be used for filling the boxes of machine-bearings, such as reapers, etc. An alloy of lead and scrap zinc, with a percentage of antimony, makes very good box linings for machinery. The amount of antimony will determine its hardness. Many machinists use old type metal as a filling for boxes, but if this metal be found too soft, add a small percentage of antimony, when it will be found to be excellent for the purpose employed.

The Stiles & Parker Press Company, Middletown, Conn., will put in, this month, one of William Wright's, Newburgh, N. Y., 6 horse power engines. The company has built an addition to the machine shop, 60x35 feet, with a clear story height of 15 feet, for the erection of their drop hammers.

The Detroit Copper and Brass Rolling Mills Company has been formed at Detroit, Mich., and has purchased a part of the Detroit Locomotive Works property. The company will manufacture sheet copper and brass, copper rivets, copper and brass wire, copper bars, bottoms, &c.

The Marine Engine Works of Chicago are establishing a new department for the manufacture of jewelers' machinery.

Burke & Matteson are erecting extensive forge works at Chicago, to execute heavy machine work and certain kinds of blacksmithing.

The Low Moor Iron Company, of Virginia, are building the largest blast furnace in the State at Low Moor.

H. F. Barrows, North Attleboro, Mass., will soon commence the erection of a large jewelry manufactory.

The Hallowell (Me.) Cotton Manufacturing Company have made a second general increase of about 10 per cent. in wages of their operatives.

The Chemical Paper Company, Holyoke, Mass., is to add the manufacture of tissue paper to its regular business, putting up a building 104x30 feet.

Estabrook & Wires, Milford, Mass., are building an addition to their factory 22x40 feet, for the manufacture of the Clinching Screw Company's machine for driving the screw, as well as the manufacture of the screw.

Henry Disston & Sons are erecting a large rolling mill at Tacony, Pa., where they propose in future to manufacture the steel which they require for their saw works.

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NEW YORK, JUNE 5, 1880.

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What to do with the Money.

It is an unusual thing for a national government to have more money than it knows what to do with, but the United States Government is in just such a fix at the present time, so far as regards the unused portion of the Geneva award, amounting to about $10,000,000. This is a nice comfortable balance to have on hand after paying all the just claims against the fund. The question is now prominently before Congress and the country—What is best to do with this money?

Some of the daily papers have suggested that it would be a grand movement to appropriate the whole amount to aid the construction of the Panama ship canal; but their zeal in this direction is not opportune, for the projectors of the canal have not solicited pecuniary aid from any government other than that of the country through which the ship canal is to be cut. Besides, so long as home improvements claim attention it would be folly to contribute money to prosecute foreign engineering enterprises, even though they be calculated to benefit some of our leading industries.

If this money were deposited in some European national treasury, under like circumstances, it would probably be expended in building and experimenting with military and naval weapons and armor, but we need no formidable preparations for human slaughter in this peaceful land of ours. The money should be so applied as to benefit the people of every section of our country. Some of it might be used to improve the Yellowstone National Park, but as only a few of our vast population could find it convenient to visit that interesting locality, the amount expended in rendering it more attractive should be moderate. Liberal appropriations are made at almost every session of Congress for harbor and river improvements, also for forts and fortifications. Civil, military and naval engineering are fostered by government and allowed liberal amounts; but mechanical engineering, which underlies all other engineering, is left to depend upon its own resources. A few years ago a Government Commission was instituted to inquire into the causes of explosions of steam boilers, and a small sum reluctantly appropriated to carry on experiments. When that was exhausted and the work only fairly under way the funds ran out, and no influence yet brought to bear upon our worthy national legislature has availed to get another appropriation for this purpose. The work had to stop, and unless more means are provided to carry it on the money already spent is virtually lost. About the same time a United States Commission was instituted to test iron steel and metals, which, although its labors were prematurely cut short by lack of means, was sufficiently supported to enable it, after some years of labor, to make a valuable report upon the work so far accomplished. Some 5000 copies of this report were printed and sent out—somewhere. A few engineers were fortunate enough to secure copies of that work, but the many are not able to procure them. Although the report is the most valuable publication of the kind in existence, and is sought for by thousands of engineers, the style of economy practiced at Washington will not, thus far, allow the expense of printing any more copies for distribution. Meanwhile demands upon the government printing-office for the extensive multiplication of copies of Congressional speeches on the Whittaker case, and other equal important subjects are promptly and fully met.

A remarkable machine for testing iron and metals has been constructed for the United States Government, which is the most accurate and efficient for this purpose in the world. This machine is in the United States Arsenal at Watertown, Mass., and, as there is no appropriation for carrying on experiments with it, every citizen who wishes to learn the strength of any metal, must make tests at his own expense. The Commission appointed to test iron, steel and other metals, have long been desirous of having means placed at their disposal to carry on experiments by aid of this valuable machine. Their request is echoed by the engineers of the country, but Congress does not respond. A small part of the Geneva award balance would enable this work to be carried on, and valuable results to be attained.

Another suitable appropriation might be made from this munificent balance of cash. The world's fair, to be held in this city in 1883, might justly receive the same amount of Government aid as did the Centennial; that is $1,500,000. The Fair might then be conducted under Government auspices, the squabbles of the two rival committees settled by authority, and some definite location and plan fixed for holding the exhibition in time to insure the highest success.

American Master Mechanics' Association—Thirteenth Annual Convention.

In our issue of June 28th, 1879, we published a synopsis of the proceedings of the annual meeting of the Master Mechanics' Association, together with a brief outline of the organization of the society and its objects.

This organization opened its thirteenth annual session, according to announcement, at the rooms of the Board of Trade in Cleveland, Ohio, Tuesday, May 11th. The attendance was good, and the Convention was not long in getting to work. An address of welcome was delivered by Mayor Herrick, of the city of Cleveland. The Mayor expressed his gratification at welcoming, on behalf of the citizens, the members of the association back to the place where their society had its birth. He referred to the fact that great and rapid progress has been made during the twelve years existence of the organization.

He also expressed his satisfaction at being a mechanic, and in sympathy with improvements in railway machinery, which bears such a marked relation to the commercial progress of the country at large. He then dwelt upon the numerous and extended advantages offered for practical, scientific investigation and discovery, and their application to railway machinery. The speaker concluded by setting forth the great benefits to be derived from the interchange of views upon the practical experience of each other. President Chapman then delivered an address, calling attention to the fact that when the society organized thirteen years ago there were but 40 members, whereas the present membership is 180.

A brief recapitulation of the doings of the society during the intervening years was offered, and an earnest exhortation to put forth new efforts in the future, in order that these meetings may be made more beneficial to the members who come with the expectation of acquiring knowledge, and although all may not be able to experiment, yet it will do no harm to know how to pursue experiments profitably.

The President then referred to the prosperous condition of the society there being at present $641 in the treasury.

The subjects for discussion at this meeting were as follows:

1. Construction of locomotive boilers.
2. Comparative performance of locomotives with regard chiefly to economy in their operation.
3. The best means of preventing smoke from locomotives with due economy of fuel.
4. Best means of preventing noise from safety valves and maintaining safety of boilers.
5. Tools and machinery.

The Committee on Boilers reported the results of some incomplete tests with a certain kind of boiler designed by a Mr. Verderber. The peculiarity of this boiler is that it has no water spaces at the sides or ends of the fire box. The sides back and top are composed of fire brick, a few inches of the cylinder part of the boiler and flue sheet alone being exposed to the action of the fire. The tubes are the chief medium through which the heat is transmitted to the water. After being in use about eight months, the flue sheet and tubes were found to be in a leaky condition. Other defects were also discovered caused in part by the accumulation of sediment over the fire box. The committee expressed a desire to hear the subject thoroughly discussed by the convention.

The report upon the comparative performance of locomotives, with regard to economy in operation, was very limited, the committee having received only eight replies.

The general opinion deduced from these reports was that the "Mogul" engine has the most advantages for freight purposes where the speed does not exceed twelve miles per hour, but for a higher rate of speed the eight-wheel engine would be the most economical. Mr. Sedgley of the L. S. and M. S. road reported a difference of $2\frac{3}{10}$ per cent. in favor of the Mogul engine. They cost the least for repairs and use less fuel. "From a statement received of the performance of a consolidation engine working on a mountain grade of 184 feet to the mile on the New Mexico and Southern Pacific extension of the Atchison, Topeka & Santa Fe Railroad, we find this engine hauled 258½ tons, not including weight of engine, on the above grade at a speed of eight miles per hour. The work done by this engine is considered by the officers of the road equal to what could be done by two ordinary engines of the American or eight-wheel class." This engine has a tank on the boiler and is known as "Uncle Dick," the dimensions of which were published in our issue of April 24, 1880, in answer to a question.

Mr. Woodcock, master mechanic, Central Railroad of New Jersey, furnished a statement of the performance of a consolidation engine, cylinder 19x24 in., used on that road. This engine has made a total mileage during the past year of 40,025 miles, with an average cost of repairs of $2\frac{8}{10}$ cts.; fuel, $7\frac{8}{10}$ cts.; stores, $\frac{8}{10}$ cent; engineer, firemen and wipers, $5\frac{9}{10}$ cents; total, $17\frac{3}{10}$ cents; miles run to ton of anthracite coal, $19\frac{6}{10}$; weight of train hauled in tons, exclusive of engine and tender, 785 tons; average grade, 21 feet to mile. These items are taken from the printed annual statement for 1879. He also states they have just received and put into service eight new consolidation engines, cylinders 20x24 in., to be run in the same service as the former engines, and thus far they are pleased with the manner in which they perform their work.

The Committee were of the opinion that the consolidation engine is destined to be the coming engine for heavy freight service.

During the discussion upon this subject, the following general conclusions were developed, viz., That the Western and other level roads would generally prefer the "Mogul" engine for heavy freight service, while the "consolidation" might be best for heavy grades.

The following question was proposed and discussed, "Is button-set riveting reliable and practicable in boiler construction?"

It was reported that riveting is done with hollow sets in Chicago, and successfully. It is believed the adoption of this method would cheapen boiler repairs materially.

The matter of filling the holes depends upon the manner the rivets are heated. By heating the rivet and cooling the point, the hole is filled completely. This makes a first-rate job.

Where button-set riveting has failed, it has been owing to bad workmanship rather than any fault in the system. It was also claimed that all steam riveting is in principle button-set riveting.

The Secretary offered the following subject, which was taken up by the meeting: "What is the best manner of annealing steel sheets after flanging?"

It was stated that some believed that boiler plates are sprung by annealing, but plates thus annealed do not crack. Before annealing, plates often crack soon after flanging.

The annealing of steel plates should be with wood fire, and never with coal. The quality of the steel is undoubtedly improved by annealing. Indeed, the annealing is absolutely necessary. Some had witnessed bad cracking from want of annealing. Properly annealed sheets never crack.

Proper facilities are needed for annealing. Some methods leave the sheets as they were before the process. Furnaces using reflected heat are best.

The Committee on the best means of Preventing Smoke from Locomotives, with due economy in fuel, reported that in their opinion it is impracticable to lay down a fixed rule giving the proportions of locomotive boilers designed to burn bituminous coal. The heating qualities of different coals vary greatly, and the grate area, number of square feet of heating surface, size of the fire box, and, in fact, the general dimensions of the boilers should be varied to correspond with the evaporative capacities of the different coals. Where the evaporative power of coal is small, large boilers and furnaces are absolutely necessary for the economical consumption of fuel and the lessening of the smoke nuisance; because coal which has limited heating capacity contains a large portion of foreign substances, which occupy a portion of the grate surface and fire box, which would be available for the purpose of combustion with a fuel having greater heating capacity and consequently fewer impurities. If it were possible to consume all the solid or gaseous substances contained in the coal, there would be no emission of smoke, but a slightly colored gas instead.

A table was here produced, showing the heating qualities of different coals. A summary of this table is that the evaporative capacity varies from 3.77 pounds of water for one pound of coal, for Fort Dodge, Iowa; coal to 5 48 for Brazil, Indiana; 5.54 for Tamaroa, Illinois, and 6.32 for Carbondale, Illinois, coal, in passenger, and 6.17 in freight service. Letters from different parties contained the following statements and suggestions:

There are now being used on some roads on locomotives in the passenger service what is known as the "Smith stack," the same as has been in use upon the Pennsylvania road for some years. In addition to it there is also in use an arrangement for admitting air to the fire box above the fire, by inserting four two-inch tubes, both in front and back of fire box, with a small jet of steam admitted just at the outer end of the tube. It is an old English device known as "Clark's" patent. The introduction of steam to the tube is to create a current of air. By opening or closing a steam cock the admission of air could be regulated, increased when fresh coal was placed on or diminished as gases were burned. There is not much saving of coal by this arrangement, with an engine, the boiler of which has to be forced to keep up steam; with heavy train at slow speed the gases will all be consumed; with heavy train at high speed they will be partly burned; at high speed with light train all will be consumed; with large boilers of ample capacity very good results are obtained. It has not yet been determined just what amount of air is necessary to give the best combustion.

Some experiments are being tried by closing or reducing the size of the tube to ascertain about the requisite amount of air. Professor P. H. Dudley claims that the results of his experiments show that too much air has generally been admitted above the grate or from below. These two combined give excellent results.

It is found that judicious firing is absolutely necessary to cleanliness and economy.

It is not believed to be possible to use bituminous coal as a fuel for hauling heavy freight trains at a moderate speed, without the emission of smoke, and considerable of it. The time is so short or the combustion so rapid that it is impossible, practically, to consume, in the locomotive fire box, the gases which form the smoke. The time must be extended and the combustion slower to do it. A fresh fire requires more air to be mixed with the gases liberated from the coal, and the quantity of air admitted should vary with the nature of the work being performed by the engine.

To get the best results from the admission of air, the device should be under the control of the engineer or fireman, and would require very frequent attention; perhaps more attention than could at all times be given by the person in charge.

Air openings and brick arches will assist in effecting a more perfect combustion of bituminous coal, but the objections to them are sufficient to offset any advantages that might be derived from their use.

It has been found by actual experiment that with a large fire-box, with properly constructed grate bars, and a fire not over six inches deep, a sufficient quantity of air can be admitted through the grate and fire bed to cause complete combustion; and that while under other conditions the use of hollow stay bolts might be found beneficial, yet under these circumstances it proves exceedingly detrimental to the engines' steaming qualities.

Mr. Johann, of the Wabash, St. Louis & Pacific Railroad, read a paper on boiler construction. The gentleman referred to advocated the "straight top" type of locomotive boiler.. To prevent the deposit of sediment upon the crown sheet he proposes to dispense with the use of crown bars, using long stays instead, arching and sloping the crown sheet, thereby adding strength as well as preventing the liability of uncovering the crown sheet in going up or down heavy grades.

By this plan more available heating surface is also claimed. The dome is to be placed nearer the center of the boiler for obvious reasons, and all parts are made more easy of access for inspection or cleaning; priming is also largely prevented. A smaller number of tubes were used and placed farther apart. This boiler is said to have larger water capacity and consequently less heating surface than other ordinary boilers; but Mr. Johann states that this boiler is in use on a passenger engine, and the imperfect trials made show most favorable results for the boiler with the least heating surface. The fire box sheets and stays were of steel, and as a whole this design of boiler is said to be stronger and cheaper than the ordinary boiler.

When these boilers were first constructed, a failure was predicted for the straight top, but when such results as the following manifested themselves, these predictions were dropped.

Miles run to the ton of coal by the two engines having these boilers, both being engaged in the same passenger service, and hauling trains averaging to the train, from Oct. 1, 1879, to May 31, 1880, 31.11 miles to the ten by wagon top; 31.73 miles to the ton by straight top.

This performance, together with that of the smaller boiler previously mentioned, tends to prove that with the character of water in use on Western roads, which as a rule is very muddy or very hard, easily forming scale, the boiler with the greatest water circulation and most open crown sheet is the most preferable and economical.

Mr. Johann contemplates prosecuting some more experiments during the coming year, and will probably be in a position to give actual results at the next annual meeting.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) S. A. B., Catskill, N. Y., asks: Will you please inform me of a cheap mode of "silver plating" for small brass articles? *A.*—The articles to be plated must first be freed from all greasy or oily substances. This may be done by boiling them in an alkaline lye (about half a pound of soda ash to the gallon of water), then washed from the lye and dipped into diluted nitric acid, which removes any oxide that may be formed upon the surface. The acid should be diluted so that it will merely act upon the metal. The articles should then be washed in clean water to remove the acid. For a plating solution to be used without the aid of a battery: Take 1 oz. of nitrate of silver dissolved in one quart of distilled or rain water. When thoroughly dissolved throw in a few crystals of hyposulphite of soda, which will at first form a brown precipitate, but which will eventually become re-dissolved if sufficient hyposulphite has been employed. A slight excess of this salt must, however, be added. The solution thus formed may be used for coating small articles of steel, brass or German silver, by simply dipping a small sponge in the solution and rubbing it over the surface of the article to be coated, which has been previously cleaned as directed. When the solution has been carefully made and the operator has had a little practice, the plating may be done in a very satisfactory manner. We refer you to our issue of May, 22, 1880, answer to W. S. H.

(2) F. H. F., Baltimore, M. D., writes: In your issue of May 1st, I find a letter from John O'Connell relating to belts, in which he says: "The theories put down in books, as well as some of the leading newspaper writers, say that the belt will always run towards the high side of the pulley," which he thinks is opposed to practice, because he places one end of the shafts nearer together than the other, and the belt runs towards the nearest end. Now, that does not change the theory of a belt running to the high side of a pulley. A pulley, to have a high side, must be of greater diameter on one edge than the other, and if he will try a pulley of that kind he will find the belt will run to the high side. *A.*—The conditions referred to were fully explained in an article which appeared in our issue of April 17, 1880, on the Running Condition of Belts, by L. F. Lyne.

(3) G. B. S., Brooklyn, N.Y., writes: I am running an upright tubular boiler in which the tubes leak badly where they are inserted in the flue sheets. They have been expanded and caulked a number of times, but still they will leak. I have thought of putting ferules inside the ends, and would like to have your opinion as to the cause of the leaking, and also the remedy. *A.*—The leaking in the boiler referred to is caused by the unequal expansion between the tubes and the shell. It is useless to attempt to hold them firmly, as the result will always be unsatisfactory. The best remedy is to take out the tubes, bore the holes in the top head 3-32 of an inch larger than the tubes, taking off the rough edge both inside and out with a file. The tubes should be inserted and fastened in the crown sheet by expanding and caulking in the ordinary way, while copper ferules are to be slipped over the top ends between the tubes and top head. These ends should also be expanded, but not turned over. The copper being more flexible than iron, will allow the tubes to expand uninterrupted, thus avoiding any unneccessary strain upon the tubes, and will be found to work satisfactorily. The application of ferules inside the tubes would not be a permanent remedy.

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MANUFACTURES.

Ground has been broken at Erie. Pa., for the erection of a large malleable iron manufactory, which will cover an acre of ground.

Several Canton capitalists are about to erect a large rolling mill on the land which has just been drained by the removal of the Nimissilla dam. It will be supplied with its ores from Cleveland.—*Cleveland (O.) Voice.*

In our issue of March, 1879, we gave an extract from the Binghamton, N. Y., Water Commissioners report showing how the cost of pumping water had been reduced by burning coal dust and screenings with the Jarvis furnace. We make the following extracts from the same commissioners' report for the year 1879:

"For the past year we have been burning an average of less than one and one-half tons of coal dust and pumping over one and one-half millions gallons of water each twenty-four hours under a water-pressure of forty-five pounds, at an average cost of $2.41 per day for fuel. The Jarvis patent furnace put up last year is giving good satisfaction, and I think is a good investment. The whole amount of coal dust consumed during the year is 494 tons, 1270 pounds; of bituminous coal, 40 tons, 1680 pounds; daily average of bituminous coal, 224 pounds; daily average of coal dust, 2710 pounds; daily average of two together, 2934 pounds. The following table will show the reduction in fuel account from Jan. 1st, 1877, up to and including 1879:

1877.....	$3016 35
1878..(Jarvis seven months)..	1761 61
1879....(Jarvis one year)....	856 23

The report also states that 250,000 gallons more water daily had been pumped in 1879 than in any previous year.

The Cleveland (O.) Rolling Mill Co., are about to erect what is said to be the largest rolling mill in the country.

The Miller Company, Canton, O., are fitting up a new iron foundry, and are about to bring out a new model boiler.

The Brass Foundry and Machine Works at Ft. Wayne, Ind., are running to their fullest capacity, employing about 550 men and melting about 125 tons of iron per day. They are about completing an addition to their foundries 200x75 feet, giving them a total extent of 800x75 feet. This is exclusive of their machine and boiler shops.

A proposition to remove the Beaver Falls, Pa., File Works has been rejected, and the stockholders have decided to erect a larger building. It will be two stories in height its entire length, and the long wing next the river 150 feet in length, and will have an upper story. A single engine of 300 horse power will be put in the works. Mr. Reeves estimates that the work will be completed in 90 days.

We should have stated last week that the mammoth Brooklyn elevator, the largest in the world, is to be run by two Buckeye engines, giving 1,400 horse power.

The foundation for the new pattern shop of the Reading (Pa.) Iron Works has been laid. The walls are two feet thick. It will be a two-story brick building, 146½ feet long by 60½ feet wide.

Preliminary operations have been begun for the erection of the largest iron foundry in the South, to be erected on the Etowah River, near Rome, Ga.

Machinists' and Engineers' Supplies.

NEW YORK, May 20th, 1880.

The general state of the supply market is much the same as when last reported. The present orders are chiefly to replace the stock disposed of, as with the present demoralized state of the iron market it is impossible to restore the confidence of buyers. It is thought, however, that iron has reached its extremity, and will probably not go any lower.

Boiler tubes may be bought at a discount of 45 to 50 per cent. from list prices.

Wrought-iron steam and gas pipe are quoted at a discount of 60 per cent. The demand is rather dull than otherwise, but encouraging.

Oil-well Tubing, 28c. to 30c. net; Casing, 80c. net.

We are informed that the Stanley Rule and Level Company were awarded the first premium on Spirit Levels, Rules, Planes and Squares at the Australian International Exhibition, just held in Sydney, New South Wales.

We have received a copy of a new illustrated price-list on Gearing, etc., from Poole & Hunt, Baltimore. It contains 92 pages, and is a very complete work for reference.

Iron Review.

NEW YORK, May 20, 1880.

The iron market is a shade better, there being more inquiries; prices have not changed.

There is more iron being sold in small lots this week than was sold last week, with indications of an increase of confidence in the near future.

Pierson & Co., 24 Broadway, N. Y., under date of May 20th, 1880, quote prices out of store as follows, although they say prices are nominal:

Iron Rails, $52½ to $57½, according to weight; Fish Plates, 2¾c. per lb.; Railway Spikes, 2½c.; Bolts and Nuts, 3¾c.; Common Bar Iron, nominal, 2 7-10c., basis from store; Refined do. 3c., basis; Ulster, 4 2-10c. basis; Machinery Steel, 7c.; Best Tool Steel, 13½c.; Norway Bar Iron, 6¼c.; Norway Shapes, 6¾c; Nail Rods, 7c.; Sheet Iron, 4c., basis; Angle Iron, 3 6-10c.; Tee Iron, 4 5-10c.; Band Iron, 3 6-10c.; Hoop Iron, 3 7-10c., and up according to size; Horse Shoe Iron, 3½c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets, 30% off in papers; 10% off in bulk.

Carmichael & Emmens, 130 Cedar St., New York, quote prices of Boiler Maker's Supplies as follows:

Flange, 5c. to 5¼c.; C. H. No. 1 Shell, 4c.; Tank, 3¼c.; C. No. 1, 3½c.; Boiler Tubes, 50% discount from list.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling Slip, New York, furnish us the following, under date of May 20th, 1880:

Pig Tin is lower than last week both here and abroad. London, £75 10s.; Singapore, $22½. Here Malacca Straits & Australian, 17c.; Billiton, 16½c.; "Lamb & Flag," 18c., and Banca, 20c.

With an absence of wholesale demand, the jobbing trade is very satisfactory. This fact, together with an almost entire cessation of arrivals for the next 60 days, is gradually working a re-adjustment and an important change in the statistical position of this article. Cookson Antimony, 21c.; Hallett's, 17½c.; Spelter, Foreign and Domestic, 6c. to 6¼c.; Pig Lead weak at 4½c.; Ingot Copper, 19c.; Nickel, $1.25; No. 1 Solder, 10c.; Half and Half, 12c.

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Wanted.—A traveling salesman familiar with steam machinery. Kelly & Ludwig, 720 Filbert St., Phila. Pa.

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A Swede, 25 years old, is desirous of obtaining a position as draughtsman, prefers Marine Engine business, is a graduate from technical High school, has served an apprenticeship in his native country and as Machinist. Address, "America," P. O. Box 166 Holyoke, Mass.

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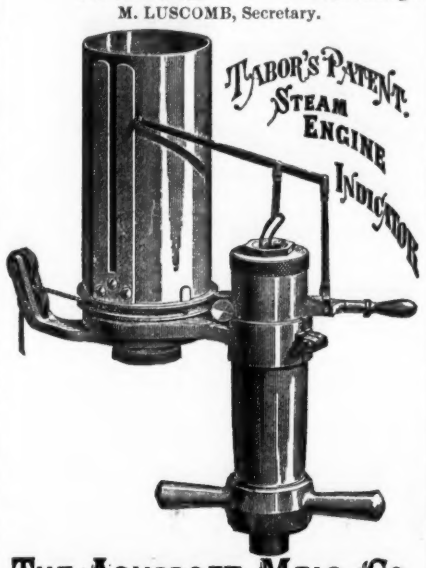

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The Cambridge Boiler Explosion.
An examination of the attack, in the columns of "The Boston Daily Advertiser," upon the judicial decision.
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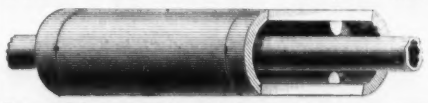
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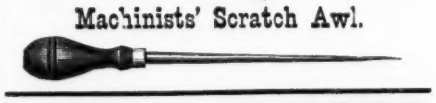

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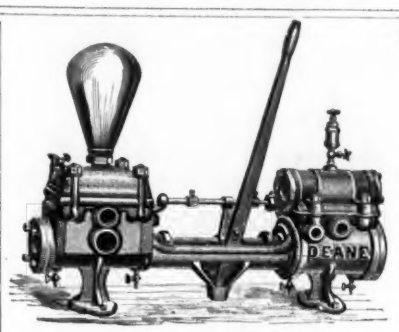

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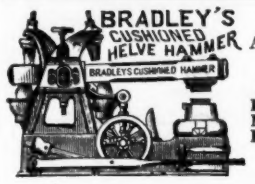

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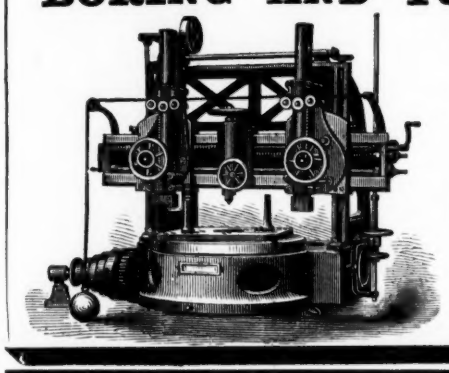

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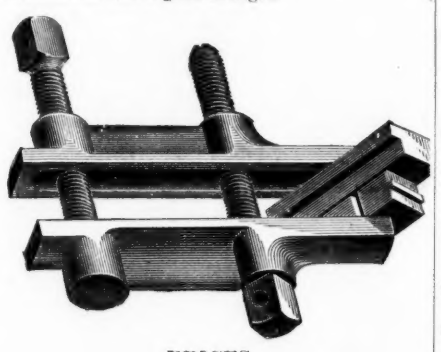

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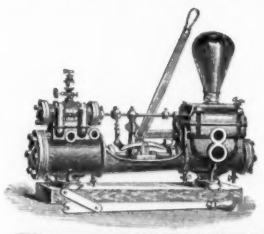

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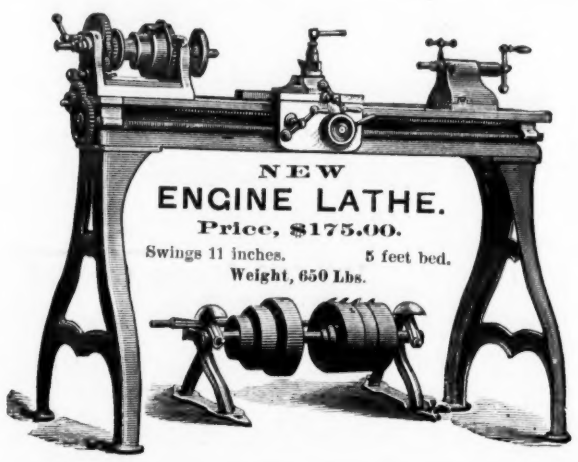

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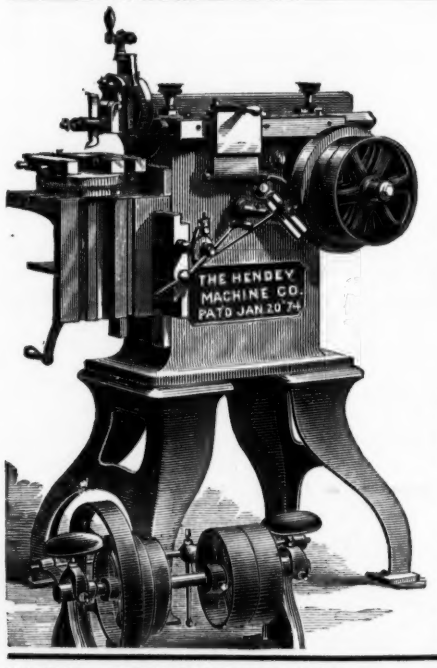

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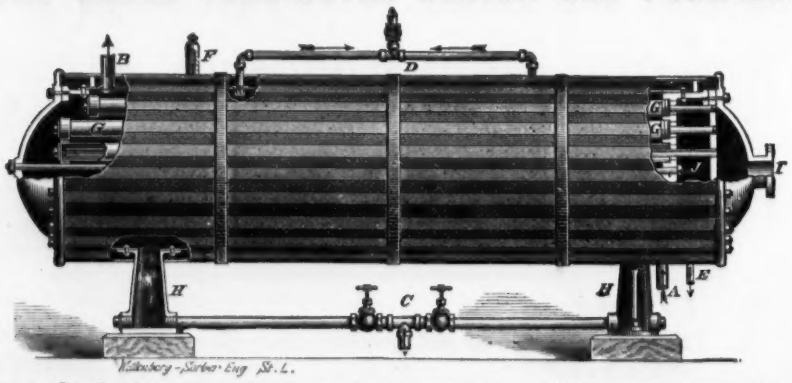

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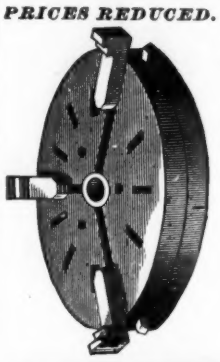

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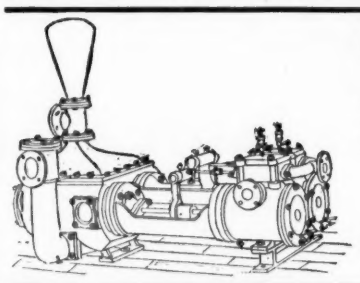

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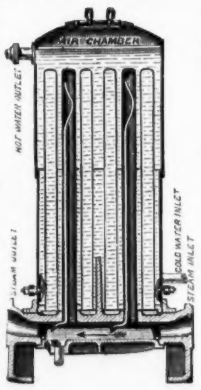

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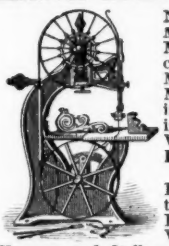

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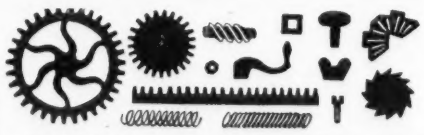

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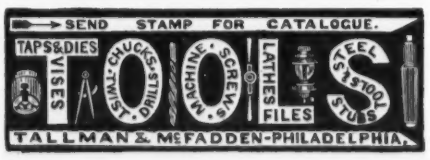

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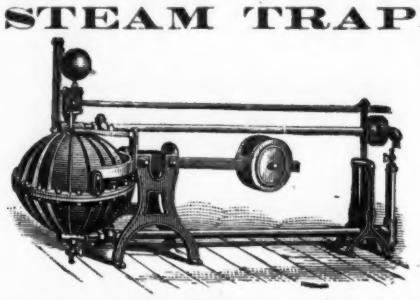

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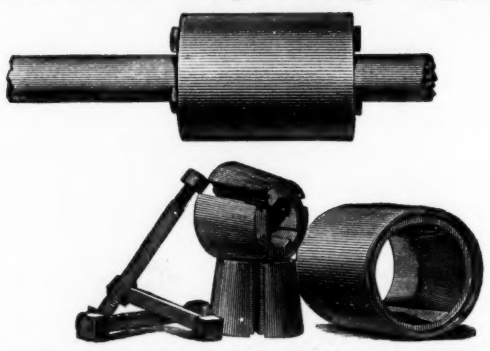

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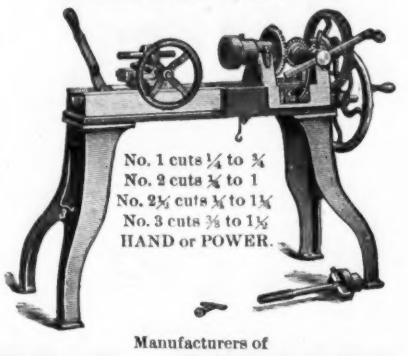

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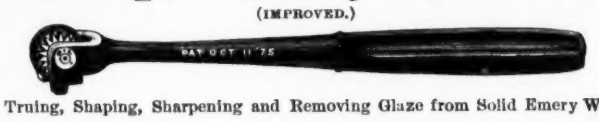

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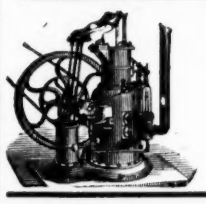

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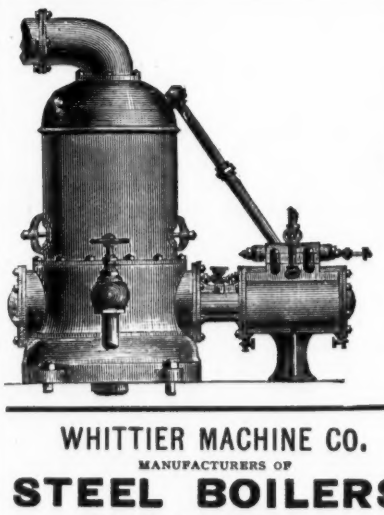

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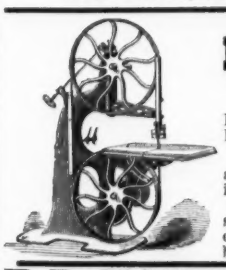

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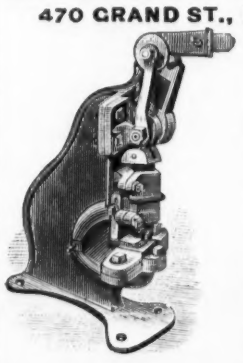

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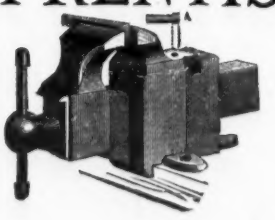

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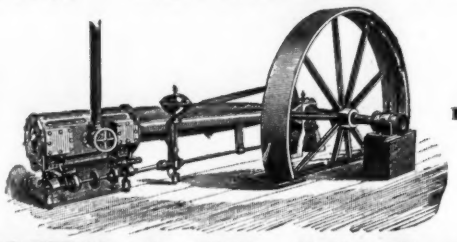

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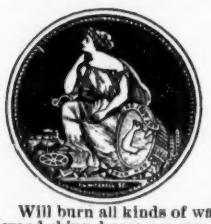

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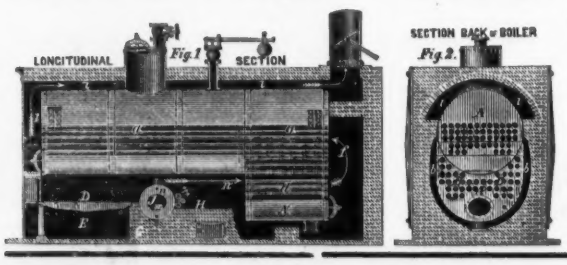

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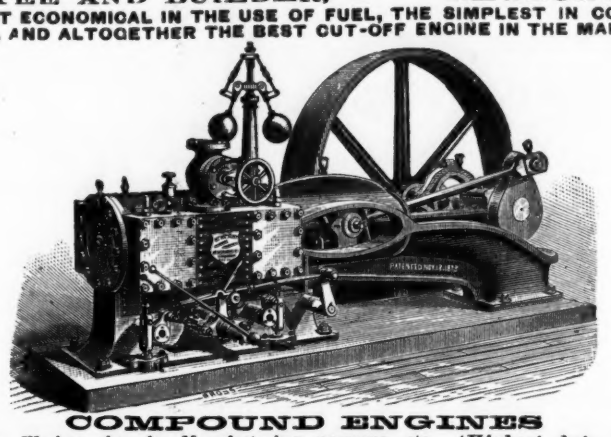

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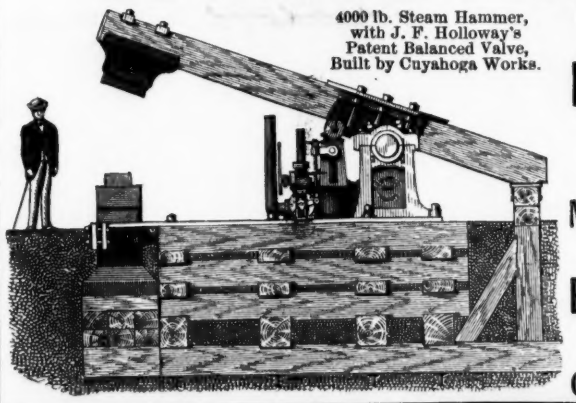

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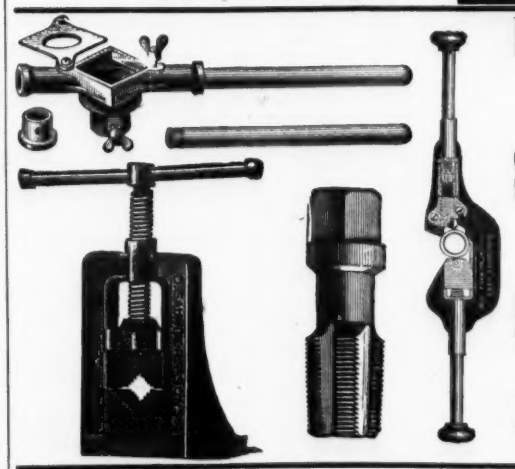

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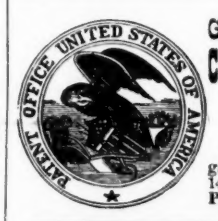

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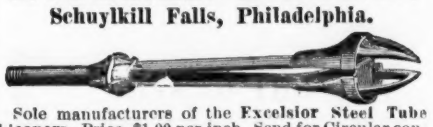

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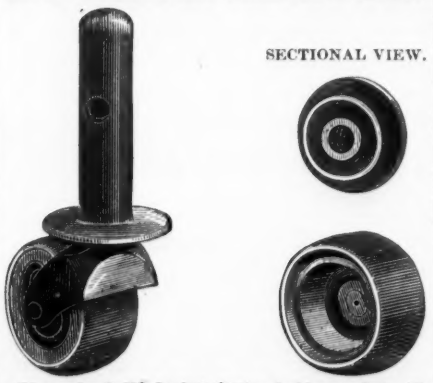

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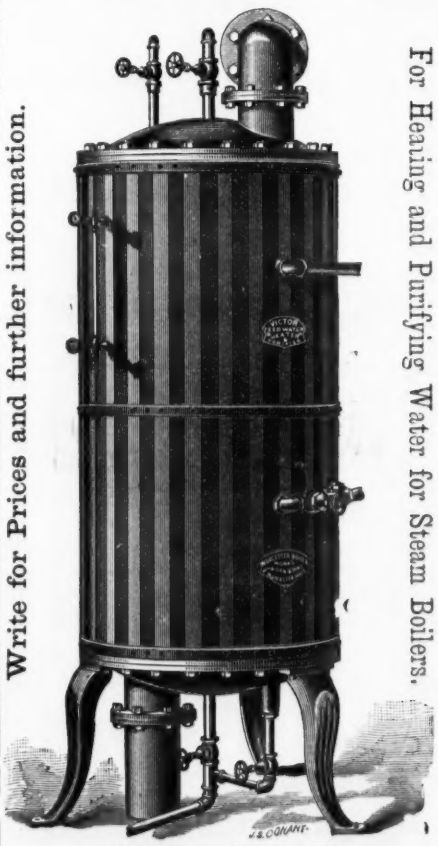

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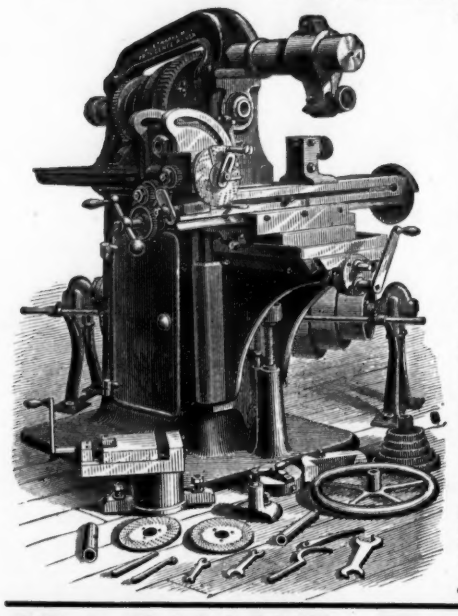

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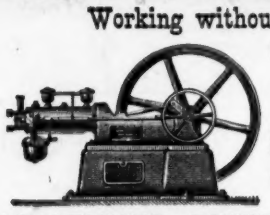

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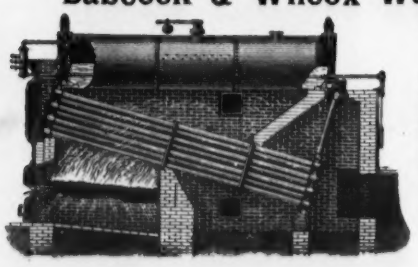

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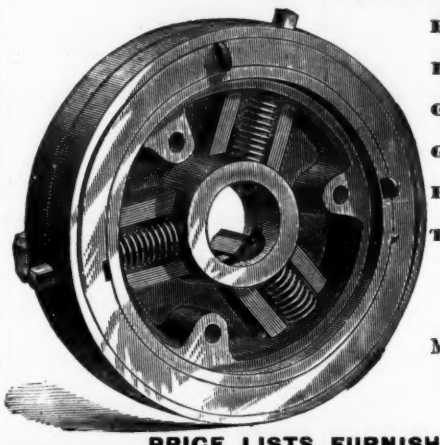

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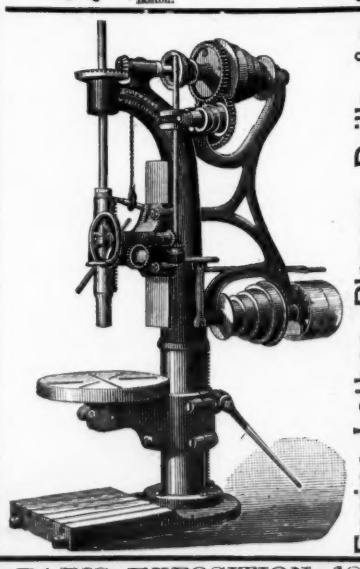

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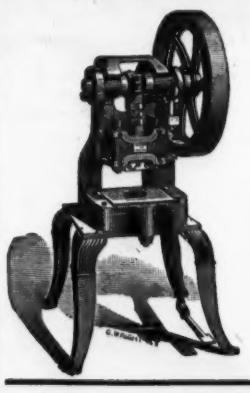

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